IDEC SmartRelay

Manual

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www.idec.com

idec

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Disclaimer of Liability

We have checked the contents of this manual for compliance with the hardware and software described. Nevertheless, discrepancies may exist. However, the data in this manual is reviewed regularly and any necessary corrections will be included in subsequent editions. Suggestions for improvement are welcomed.

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Welcome to IDEC SmartRelay

Dear customers,

Thank you for purchasing IDEC SmartRelay, and congratulations on your decision. In IDEC SmartRelay you have acquired a logic module that meets the stringent quality requirements of ISO9001.

IDEC SmartRelay is universal in application. Its comprehensive functionality and great ease of use make it a highly cost-efficient solution for virtually any application.

IDEC SmartRelay documentation

This IDEC SmartRelay manual tells you how to install, program and use IDEC SmartRelay.

You can find information on wiring in the IDEC SmartRelay manual as well as in the IDEC SmartRelay product information that is supplied with each device. You can get further information on programming IDEC SmartRelay via the PC in the WindLGC online help system. WindLGC is the IDEC SmartRelay programming software for PCs. It runs under WINDOWS and will help you get to know IDEC SmartRelay and to write, test, print out and archive programs independently of IDEC SmartRelay.

Guide to the manual

We have subdivided this manual into 9 chapters:

- *Getting to Know IDEC SmartRelay*
- *Installing and Wiring IDEC SmartRelay*
- *Programming IDEC SmartRelay*
- *IDEC SmartRelay Functions*
- *Parameterizing IDEC SmartRelay*
- *IDEC SmartRelay's Memory Cartridge*
- *IDEC SmartRelay Software*
- *Applications*
- *Appendices*

Safety guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

Danger

Indicates that death, severe personal injury or substantial damage to property will result if proper precautions are not taken.

Warning

Indicates that death, severe personal injury or substantial damage to property can result if proper precautions are not taken.

Caution

Indicates that personal injury or damage to property can result if proper precautions are not taken.

Note

Draws your intention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Warning

Only **qualified personnel** *should be allowed to install and work on this equipment. Qualified personnel are defined as persons who are authorized to commission, to ground and to tag circuits, equipment and systems in accordance with established safety practices and standards.*

Warning

This device may only be used for the applications described in the catalog and the technical description, and only with non-IDEC devices or components if they have been approved or recommended by IDEC.
This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

1 Getting to Know IDEC SmartRelay

What is IDEC SmartRelay ?

IDEC SmartRelay is the universal logic module from IDEC.
IDEC SmartRelay integrates:

- Control functions
- An operating and display unit
- Power supply
- An interface for Memory Cartridges and a PC Cable
- Ready–to–use general functions that are often required in day–to–day operation, such as functions for on/off delays and current impulse relays
- Time switch
- Binary markers
- Inputs and outputs according to the device type

What can IDEC SmartRelay do?

You can use IDEC SmartRelay for domestic and installation engineering tasks (e.g. stairway lighting, external lighting, sun blinds, shutters, shop window lighting etc.), switch cabinet engineering and mechanical and apparatus engineering (e.g. gate control systems, ventilation systems, or rainwater pumps etc.).

What device types are available?

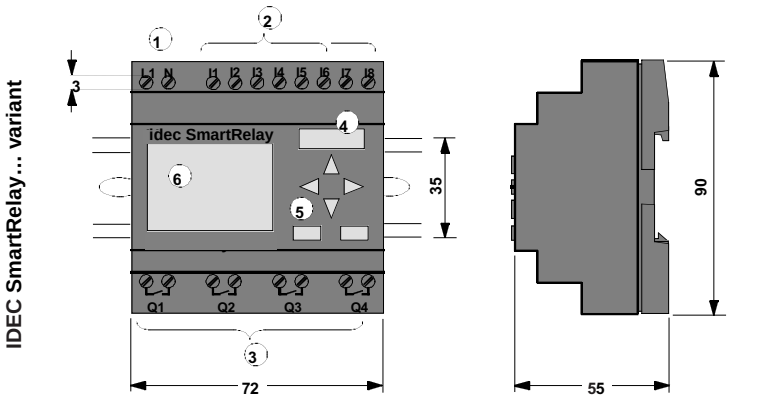
There are IDEC SmartRelay models for 12V DC, 24V DC, 24V AC and 100-240V AC as:

- FL1A-H10RCA, FL1A-H10RCB, FL1A-B10RCA and FL1A-B10RCB with 6 inputs and 4 outputs with dimensions of 72 x 90 x 55 mm
- FL1A-B10…, FL1A-B12… without a display with dimensions of 72 x 90 x 55 mm
- FL1A-H12SND, FL1A-H12RCE and FL1A-B12RCE with 8 inputs (6 Digital inputs and 2 Analog inputs) and 4 outputs with dimensions of 72 x 90 x 55 mm
- IDEC SmartRelay includes 29 ready to use general and special functions for program creation.

It’s your choice

The variety of options can be adapted very easily to your own specific task.

How IDEC SmartRelay is structured



1. Power supply
2. Inputs
3. Outputs
4. Module shaft with cover
5. Control panel (not with FL1A-B10 … , FL1A-B12…)
6. LCD (not with FL1A-B10 …, FL1A-, B12…)

How to recognize which IDEC SmartRelay model you have: IDEC SmartRelay's designation contains information on various characteristics:

- 10: Total I/Os
- 12: Total I/Os
- R: Relay outputs (without R: Transistor output)
- C: Integrated seven–day time switch
- H: Variant with display
- B: Variant without display

We also use icons to describe the different types of IDEC SmartRelay. They are used whenever information refers to only some of the IDEC SmartRelay variants:

Standard variant with 6 or 8 inputs and 4 outputs with dimensions of 72 x 90 x 55 mm

Standard variant without a display with 6 or 8 inputs and 4 outputs with dimensions of 72 x 90 x 55 mm

Variants

The following different variants of IDEC SmartRelay are available:

Symbol	Type No.	Outputs	Type
	FL1A-H12RCE *	4 x 230 V; 10A	Relay
	FL1A-H12SND *	4 x 24 V; 0.3 A	Transistor
	FL1A-H10RCA	4 x 230 V; 10 A	Relay
	FL1A-H10RCB	4 x 230 V; 10 A	Relay
	FL1A-B12RCE *	4 x 230 V; 10 A	Relay
	FL1A-B10RCA	4 x 230 V; 10A	Relay
	FL1A-B10RCB	4 x 230 V; 10A	Relay
*: Also with analog inputs			

Certification, recognition and approval

IDEC SmartRelay has UL, CSA and FM certification.

- UL listing mark
  Underwriters Laboratories (UL) to
  UL 508 standard, file no. E116536
- CSA Certification Mark
  Canadian Standard Association (CSA) to
  standard C22.2 No. 142, file no. LR 48323
- FM approval
  Factory Mutual (FM) Approval to
  Standard Class Number 3611, Class I, Division 2,
  Group A, B, C, D

Warning

Personal injury and material damage may be incurred.
In potentially explosive areas, personal injury or property damage can result if you withdraw a connector while the system is in operation.
Always ensure that the system is off
before you disconnect IDEC SmartRelay plug connections and associated components in potentially explosive areas.

IDEC SmartRelay carries CE marking, complies with the VDE 0631 and IEC 1131 standards and has interference suppression to EN 55011 (limit class B).
Shipbuilding certification has been granted.

- ABS - American Bureau of Shipping
- BV - Bureau Veritas
- DNV - Det Norske Veritas
- GL - Germanischer Lloyd
- LRS - Lloyds Register of Shipping
- PRS - Polski Rejestr Statków

IDEC SmartRelay can therefore be used both in industry and at home.

Marking for Australia

The marking shown on the left meets the requirements of the AS/NZS 2064 Standard (Class A).

2 Installing and Wiring IDEC SmartRelay

General guidelines

You should keep to the following guidelines when you install and wire your IDEC SmartRelay:

- Ensure that you comply with all the valid and mandatory standards when wiring your IDEC SmartRelay device. You should also heed any national and regional regulations when installing and operating the devices. Contact the relevant authorities to find out the standards and regulations that apply in your specific case.
- Use wires with the appropriate cross–section for the amount of current involved. You can wire IDEC SmartRelay using wires with a cross–section of between 1.5 mm^2 and 2.5 mm^2 (see Section 2.2).
- Don't screw the connectors too tightly. The maximum torque is 0.5 Nm (see Section 2.2).
- Keep wiring distances as short as possible. If longer wires are necessary, a shielded cable should be used. You should lay wires in pairs: a neutral conductor together with a phase conductor or signal conductor.
- Isolate AC wiring and high–voltage DC wiring with rapid operating sequences from low–voltage signal wiring.
- Ensure that the wires have the required strain relief.
- Provide suitable over voltage protection for wires that could be vulnerable to lightning.
- Do not connect an external power supply to an output load parallel to a DC output. This can result in reverse current at the output unless you have a diode or a similar block in your configuration.

Note

IDEC SmartRelay must be installed and wired by a trained technician who knows and complies with both the universally applicable engineering rules and the regulations and standards that apply in specific cases.

2.1 Installing/Removing IDEC SmartRelay

Dimensions

The dimensions of IDEC SmartRelay comply with DIN 43880.

IDEC SmartRelay must be snapped onto a DIN rail with a width of 35 mm to DIN EN 50022.

Width of IDEC SmartRelay:

- IDEC SmartRelay is 72 mm wide, which corresponds to the size of all modules.

Note
We will show you how to install and uninstall IDEC SmartRelay with the aid of an illustration of the FL1A-H10RCB. The measures described also apply to all other IDEC SmartRelay modules.

Installing

To install IDEC SmartRelay on a DIN rail, proceed as follows:

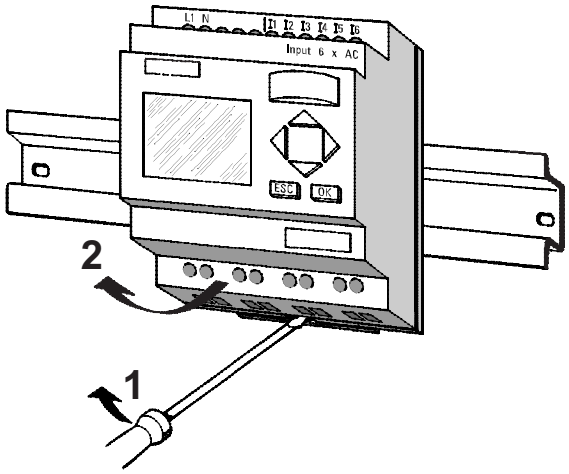
1. Place IDEC SmartRelay on the rail
2. Swivel it onto the rail so that the snap catch on the back of IDEC SmartRelay engages.

Depending on the type of DIN rail used, the snapping mechanism may be a bit stiff. If it is too stiff and IDEC SmartRelay won't snap on, you can pull the snap catch down a little as you do when uninstalling IDEC SmartRelay (as described below).

Removing

To remove IDEC SmartRelay, proceed as follows:

1. Insert a screwdriver in the hole shown in the picture at the lower end of the snap catch, and pull the snap catch downwards.



2. Swivel it away from the DIN rail.

2.2 Wiring IDEC SmartRelay

Use a screwdriver with a 3 mm head to wire IDEC SmartRelay.
You don't need wire end ferrules for the connectors. You can use wires up to the following sizes:

- 1 x 2.5 mm^2
- 2 x 1.5 mm^2 for each second connector compartment

Connecting torque: 0.4...0.5 Nm or 3...4 LBin

Note
Install IDEC SmartRelay in a distribution box or control cabinet, ensuring that the connectors are covered. If they are not, there is a danger of touching live parts.

2.2.1 Connecting the Power Supply

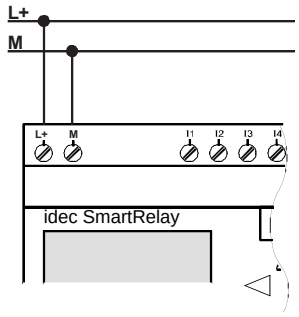
FL1A-H10RCB and FL1A-B10RCB are suitable for line voltages with a rating of 100V AC and 240V AC. Other Types are suitable for 12V DC, 24V DC or 24V AC supply voltage. Note the information on connection in the product information document shipped with your device and the technical specifications in Appendix A relating to the permissible voltage tolerances, line frequencies and current inputs.

Note
Power failure might result in a voltage spike after power restoration, which may affect certain edge-triggered function blocks.

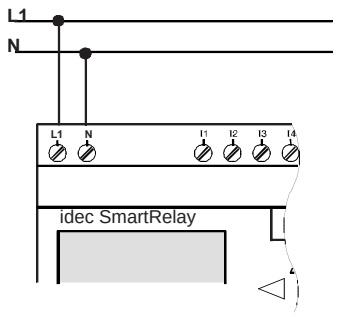
Connecting

To connect IDEC SmartRelay to the system, proceed as follows:

FL1A-H12RCE / -B12RCE



FL1A-H10RCB / -B10RCB



Protection by fuse
if required (recommended).
FL1A-H12RCE / -B12RCE : 0.8A
FL1A-H12SND : 2.0A

Note
IDEC SmartRelay has protective insulation. A ground terminal is not necessary.

2.2.2 Connecting IDEC SmartRelay's Inputs

Prerequisites

Connect sensors to the inputs. The sensors may be pushbuttons, switches, photoelectric barriers, daylight control switches etc.

Sensor attributes for IDEC SmartRelay

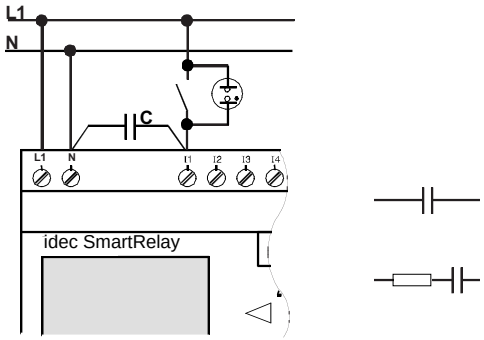
	FL1A-H12RCE, FL1A-B12RCE	
	I1 ... I6	**I7, I8**
Circuit state 0	< 5V DC	< 5V DC
Input current	< 1.0 mA	< 0.05 mA
Circuit state 1	> 8V DC	> 8V DC
Input current	> 1.5 mA	> 0.1 mA

	FL1A-H12SND	
	I1 ... I6	**I7, I8**
Circuit state 0	< 5V DC	< 5V DC
Input current	< 1.0 mA	< 0.05 mA
Circuit state 1	> 8V DC	> 8V DC
Input current	> 1.5 mA	> 0.1 mA

	FL1A-H10RCA FL1A-B10RCA	**FL1A-H10RCB FL1A-B10RCB**
Circuit state 0	< 5V AC	< 40V AC
Input current	< 1.0 mA	< 0.03 mA
Circuit state 1	> 12V AC	> 79V AC
Input current	> 2.5 mA	> 0.08 mA

Sensor connections

Connecting glow lamps, 2–wire proximity switch for FL1A-H10RCB and FL1A-B10RCB



Circuit state change 0 → 1 / 1 → 0

When the circuit state changes from 0 to 1, circuit state 1 and, in the case of a change from 1 to 0, circuit state 0 must be in place for at least one program cycle for **IDEC SmartRelay** to recognize the new circuit state.

The cycle time of the program processing depends on the size of the program.

In the appendix you can find a description of a short test program that will help you to work out the current cycle time.

Fast inputs

IDEC SmartRelay (apart from FL1A-H10RCB, FL1A-B10RCB, FL1A-H10RCA and FL1A-B10RCB) also has inputs for frequency functions. The same restrictions do not apply to these fast inputs. The fast inputs are the last two inputs on a IDEC SmartRelay:

- IDEC SmartRelay Standard variant: inputs I5/I6

Analog inputs

With units FL1A-H12SND, FL1A-H12RCE and FL1A-B12RCE, the inputs I7 and I8 can be used as normal digital inputs or as analog inputs. How the input is used depends on its purpose in the IDEC SmartRelay control program. You can use the digital capability of the input with I7/I8 and its analog capability with the identifiers AI1 and AI2.
Also see Section 4.1.

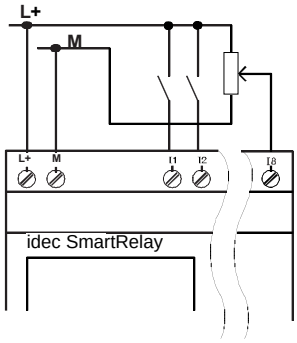
Note

Always use twisted wires for analog signals, and keep them as short as possible

Sensor connections

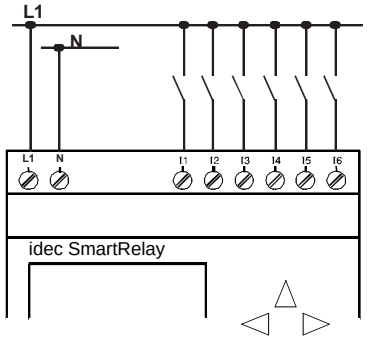
To connect the sensors to IDEC SmartRelay, proceed as follows:

FL1A-H12RCE / -B12RCE



The inputs of FL1A-H12RCE/-B12RCE are non-isolated and therefore require the same reference potential (ground) as the power supply. You can also pick up analog signals between the power supply and ground.

FL1A-H10RCB / -B10RCB



Warning

Existing safety regulations (VDE 0110, ... and IEC 1131, ..., as well as UL and CSA) prohibit the connection of different phases to the inputs of FL1A-H10RCB / -B10RCB.

2.2.3 Connecting Outputs

FL1A-...R...

The outputs of FL1A-...R... are relays. The contacts of the relays are isolated from the power supply and from the inputs.

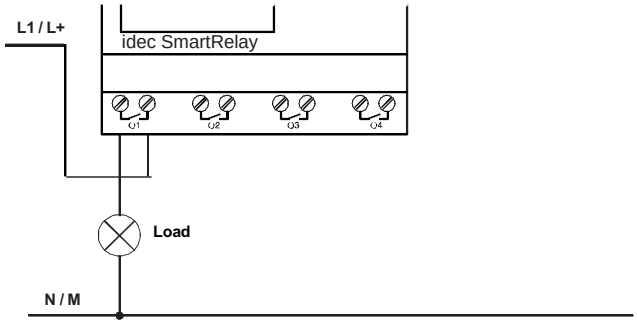
Prerequisites for relay outputs

You can connect different loads to the outputs such as lamps, fluorescent tubes, motors, contactors etc. The loads connected to FL1A-...R... must have the following properties:

- The maximum switched current depends on the type of load and the number of operations. You will find more information on this in the technical specifications.
- When switched on (Q = 1), the maximum current is 10 amperes (8A at 240V AC) for a non–inductive load and 3 amperes (2A at 12/24V AC/DC) for an inductive load.

Connecting

To connect the load to FL1A-...R... variants, proceed as follows:



Protection with automatic circuit breaker (max. 16 A, B16)

IDEC SmartRelay with transistor outputs

IDEC SmartRelay variants with transistor outputs can be identified by the fact that the letter R is missing from their type designation. The outputs are short circuit–proof and overload–proof. A separate voltage supply to the load is not necessary since IDEC SmartRelay supplies the load with voltage.

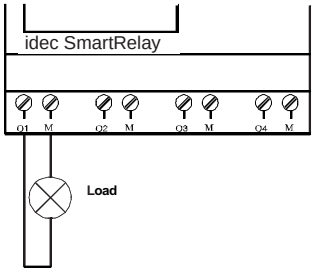
Prerequisites for transistor outputs

The load connected to IDEC SmartRelay must have the following properties:

- The maximum switched current is 0.3 amperes per output.

Connecting

To connect the load to IDEC SmartRelay with transistor outputs, proceed as follows:



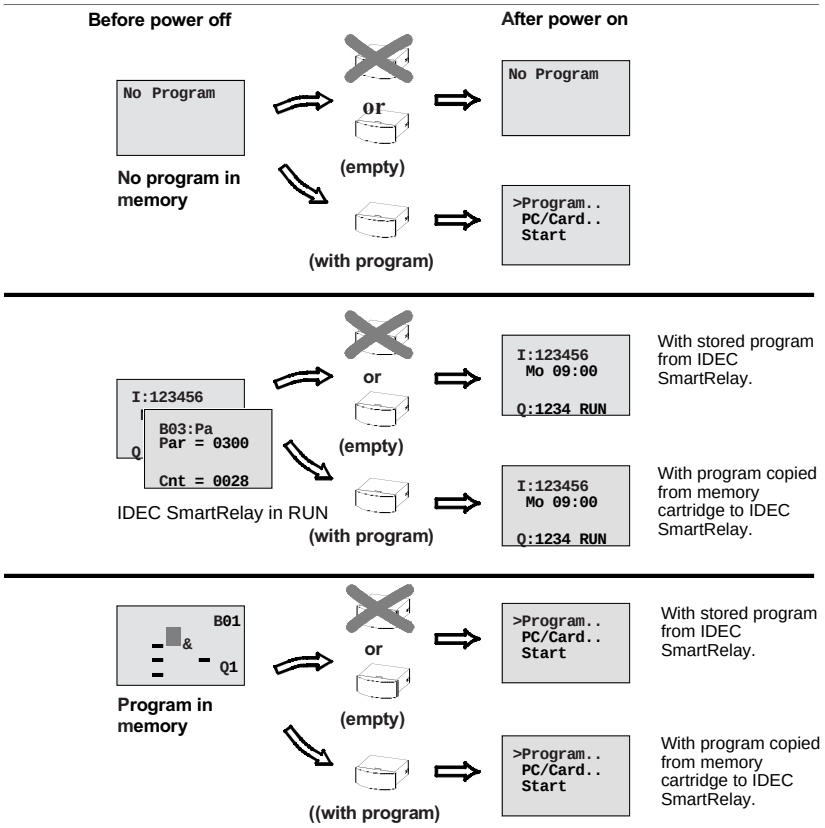
Load: 24 V DC, 0.3 A max.

2.3 Switching IDEC SmartRelay On/Resumption of Power Supply

IDEC SmartRelay does not have a power switch. How IDEC SmartRelay responds when switched on, depends on the following:

- Whether a program is stored in IDEC SmartRelay.
- Whether a program module is connected.
- Whether it is a IDEC SmartRelay variant without a display (FL1A-B...).
- The state IDEC SmartRelay was in before power off.

The table indicates IDEC SmartRelay's response to the possible situations:



Try to remember the 4 simple rules for starting IDEC SmartRelay:

1. If there is no program in IDEC SmartRelay or on the connected memory cartridge, IDEC SmartRelay (with display) displays the message: No Program.
2. If there is a program on the program module, it is automatically copied to IDEC SmartRelay. If there is already a program in IDEC SmartRelay, it is overwritten.

3. If there is a program in IDEC SmartRelay or on the memory cartridge, IDEC SmartRelay adopts the operating status it had before power off. If you are using a variant without display (FL1A-B…), it automatically changes from STOP to RUN (the LED changes from red to green).
4. If you have switched on retentivity for at least one function or are using a function with retentivity permanently switched on, its current values are retained at power off.

Note

If a power failure occurs while you are entering a program, you will find when the power is restored that IDEC SmartRelay no longer contains the program.

You should therefore save your original program before changing it on a Memory Cartridge or on a computer (WindLGC).

IDEC SmartRelay operating modes

IDEC SmartRelay has 2 operating modes: STOP and RUN

STOP	RUN
• Display: 'No Program' (not FL1A-B…) • Switch IDEC SmartRelay to programming mode • The LED lights up red (FL1A-B… only)	• Display: Mask for monitoring the inputs and outputs (after START in the main menu) (not FL1A-B…) • Switch IDEC SmartRelay to parameterization mode (not FL1A-B…) • The LED lights up green (FL1A-B… only)
Action by IDEC SmartRelay: • The inputs are not read. • The program is not executed. • The relay contacts are always open or the transistor outputs are switched off.	Action by IDEC SmartRelay: • IDEC SmartRelay reads the state of the inputs. • IDEC SmartRelay calculates the state of the outputs with the program. • IDEC SmartRelay switches the relays/transistor outputs on or off.

3 Programming IDEC SmartRelay

The first steps with IDEC SmartRelay

By programming we mean entering a circuit. An IDEC SmartRelay program is really no more than a circuit diagram represented in a different way.
We have changed the way it is represented to suit IDEC SmartRelay's display panel. In this chapter we will show you how to use IDEC SmartRelay to turn your applications into IDEC SmartRelay programs.

Note
The IDEC SmartRelay variants without a display - FL1A-B12RCE, FL1A-B10RCA and FL1A-B10RCB do not have an operating unit. They are mainly intended for serial applications in small machine and apparatus construction. FL1A-B... variants are not programmed on IDEC SmartRelay. Programs from WindLGC or from memory cartridge of other IDEC SmartRelay devices are transferred into IDEC SmartRelay.

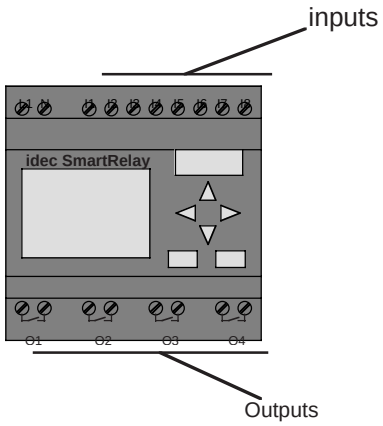
In the first section of the chapter a brief example will help you get to know how to use IDEC SmartRelay.

- We begin by introducing two basic terms, **connector** and **block,** and showing you what is meant by them.
- In step two we will develop a program from a simple, conventional circuit.
- In the third step you can then enter this program directly into IDEC SmartRelay.

After reading through only the first few pages of this manual, you will already have stored your first executable program in IDEC SmartRelay. Using suitable hardware (switches etc.) you will then be able to carry out your first tests.

3.1 Connectors

IDEC SmartRelay has inputs and outputs:



Each inputs is identified by the letter I and a number. When you look at IDEC SmartRelay from the front, you can see the connectors for the inputs at the top.
The letter Q and a number identifies each output. You can see the connectors of the outputs in the figure below.

IDEC SmartRelay's connectors

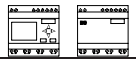
The term connector refers to all connections and states in IDEC SmartRelay.

The inputs and outputs can have the state '0' or '1'. '0' means there is no voltage at the input; '1' means that there is. But that is unlikely to be new to you.

We introduced the connectors hi, lo and x, in order to facilitate program entry for you. 'hi' (high) has the fixed state '1' and 'lo' (low) has the fixed state '0'.

If you don't want to wire an input on a block, use the 'x' connector. You can find out what a block is on the next page.

IDEC SmartRelay recognizes the following connectors:

Connectors	
Inputs	I1... I6, I7 (AI1), I8 (AI2)
Outputs	Q1...Q4
lo	Signal with level '0' (off)
hi	Signal with level '1' (on)
x	An existing connection that is not used

3.2 Blocks and Block Numbers

In this chapter, we will describe how you can create extensive circuits with the aid of IDEC SmartRelay's elements and how the blocks are linked to each other and to the inputs and outputs.

For this purpose, please turn to Section 3.3. There we describe how to turn a conventional circuit into a IDEC SmartRelay program.

Blocks

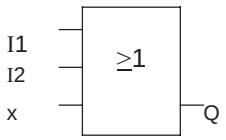
A block in IDEC SmartRelay is a function that converts input information into output information. With earlier variants of IDEC SmartRelay you had to wire up the individual elements in the control cabinet or terminal box.

When you program IDEC SmartRelay you connect connectors with blocks. To do this, simply select the connection you require from the **Co** menu (Co stands for connector).

Logic operations

The simplest blocks are logic operations:

- AND
- OR
- ...



Inputs I1 and I2 are connected to the OR block. The last input of the block is not used and is therefore marked with an x.

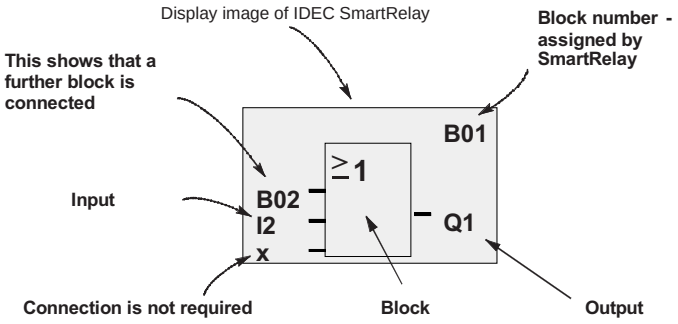
We have made the special functions far more powerful than before:

- Current impulse relay
- Counter
- On delay
- ....

Chapter 4 provides a complete list of IDEC SmartRelay's functions.

Displaying a block in IDEC SmartRelay

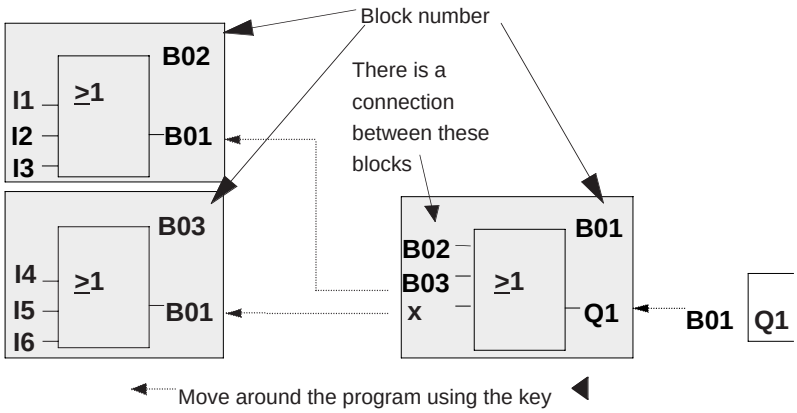
The figure below shows a typical IDEC SmartRelay display. As you can see only one block can be shown at a time. We have therefore introduced block numbers to help you to check how the circuit is structured.



Assigning a block number

Whenever you insert a block in a program, IDEC SmartRelay assigns that block a number.

IDEC SmartRelay uses the block number to indicate the connections between the blocks. The block numbers are therefore chiefly meant to help you find your way around the program.



The overview display shows you three displays of IDEC SmartRelay, which together make up the program. As you can see IDEC SmartRelay links the blocks with one another by means of the block numbers.

Advantages of the block numbers

You can connect almost any block to an input of the current block using its block number. In this way you can use the interim results of logic or other operations more than once. This saves you the work required to enter things again as well as memory space, and ensures that your circuit remains clear.

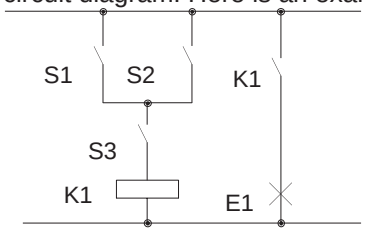
Note

To make working with IDEC SmartRelay particularly efficient, we recommend that you draw up a diagram overview of the program. This will make it easier to create the program. You can then enter the block numbers assigned by IDEC SmartRelay in this diagram.
If you use the WindLGC to program IDEC SmartRelay, you can display and print out a ladder program. You can create a functional block diagram of your program immediately using WindLGC.

3.3 From the Circuit Diagram to IDEC SmartRelay

How a circuit is represented in a circuit diagram

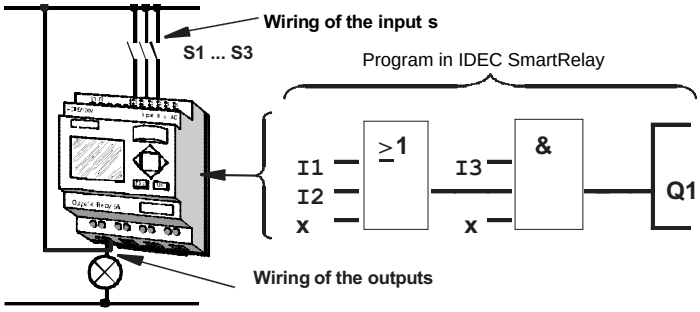
You know, of course, how a circuit is represented in a circuit diagram. Here is an example:



E1 is switched on and off by means of the switches (S1 **OR** S2) **AND** S3.
The relay K1 picks up, when S1 or S2 and also S3 are closed.

Implementing a circuit with IDEC SmartRelay

You create a circuit In IDEC SmartRelay by connecting blocks and connectors to each other:

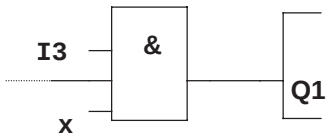


To implement a circuit in IDEC SmartRelay, begin at the output of the circuit.

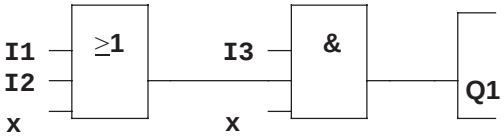
The output is the load or the relay that is supposed to operate.

You convert the circuit to blocks. To do this, go through the circuit from the output to the input:

Step1: At output Q1 there is a series connection of the normally open contact S3 with another circuit component. The series connection corresponds to an AND block:



Step 2: S1 and S2 are connected in parallel. The parallel connection corresponds to an OR block:



You have now provided a complete description of the circuit for IDEC SmartRelay. You now need to connect the inputs and outputs to IDEC SmartRelay.

Wiring

Connect switches S1 to S3 to the screw connectors of IDEC SmartRelay:

- Connect S1 to connector I1 on IDEC SmartRelay
- Connect S2 to connector I2 on IDEC SmartRelay
- Connect S3 to connector I3 on IDEC SmartRelay

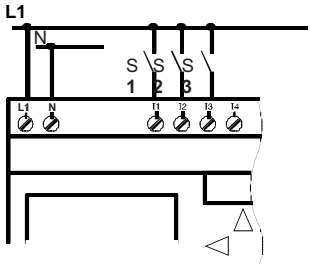
Only 2 inputs of the OR block are used so the third input must be marked as unused. The x next to it indicates this.

Likewise, only 2 inputs of the AND block are used. The third input is therefore also marked as 'unused' by an x next to it.

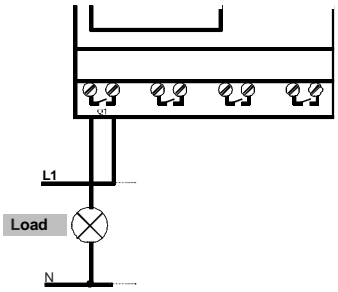
The output of the AND block controls the relay at output Q1. Consumer E1 is connected at output Q1.

Wiring example

The following table shows you the wiring based on a 240 VAC variant of IDEC SmartRelay.



Wiring of the inputs



Wiring of the outputs

3.4 The 4 Golden Rules for Working with IDEC SmartRelay

Rule 1
3–finger grip

- Enter the circuit in programming mode. Switch to programming mode by pressing the 3 keys ◀, ▶ and OK at the same time.
- Change the values of times and parameters in parameterization mode. Switch to parameterization mode by pressing the 2 keys **ESC** and **OK** at the same time.

Rule 2
Outputs and inputs

- Always enter a circuit from output to input.
- You can connect an output to several inputs, but not several outputs to one input.
- You can’t connect an output to a preceding input within a program path. Insert markers or outputs in such cases (recursions).

Rule 3
Cursor and cursor movement

The following applies when entering a circuit:

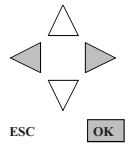
- When the cursor appears in the form of an underscore, you can move the cursor:
  - Use the keys ◄, ►, ▼ or ▲ to move the cursor in the circuit.
  - Press OK to select a connector/block.
  - Press ESC to exit circuit input.
- When the cursor appears in the form of a solid block, you should select a connector/block
  - Use the keys ▼ or ▲ to select a connector/block.
  - Press OK to accept a selection.
  - Press ESC to go back one step.

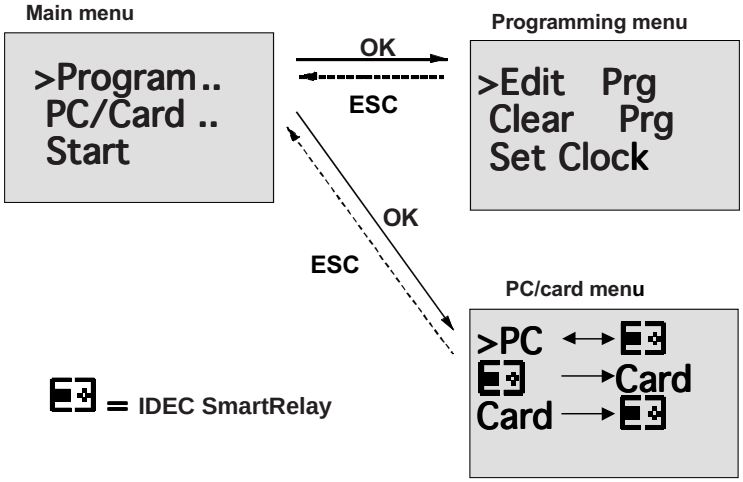
Rule 4
Planning

- Before you enter a circuit, draw up a complete plan of it on paper or program IDEC SmartRelay directly using WindLGC.
- IDEC SmartRelay can only store complete programs. If you enter an incomplete program, IDEC SmartRelay *is not able to exit Programming mode.*

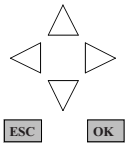
3.5 Overview of IDEC SmartRelay's menus

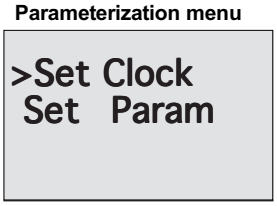
Programming mode





Parameterization mode



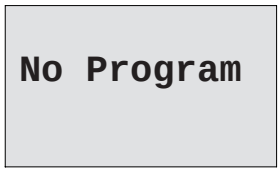


3.6 Entering and Starting a Program

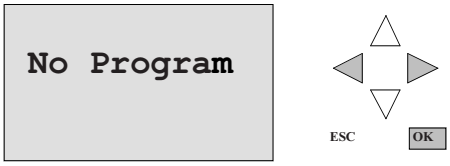
You have designed a circuit and now want to enter it in IDEC SmartRelay. The example below illustrates how to do this.

3.6.1 Switching to Programming Mode

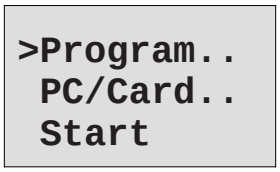
Connect IDEC SmartRelay to the power and turn it on. The following message appears on the display:



Switch IDEC SmartRelay to programming mode To do this, press the keys ◀, ▶ and **OK** at the same time. The fact that you have to press the keys simultaneously prevents anyone pressing them and switching to programming mode inadvertently.

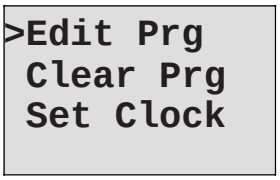


When you press the keys, IDEC SmartRelay's main menu appears:



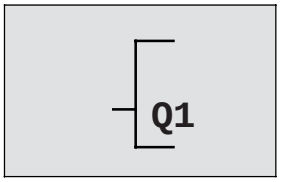
IDEC SmartRelay's main menu

On the left in the first line you will see ”>”. Use the keys ▲ and ▼ to move the ”>” up and down. Move the ”>” to ”Program..” and press OK. IDEC SmartRelay switches to the programming menu.



IDEC SmartRelay’s programming

Here too, you can move the ”>” by pressing the ▲ and ▼ keys. Position the ”>” on ”Edit Prg” (i.e. to enter the program) and press OK. Smart Relay then displays the first output:



IDEC SmartRelay’s first output

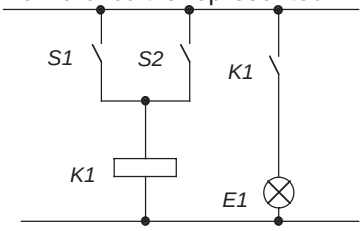
Use the ▲ and ▼ keys to select the other outputs. At this point, you begin to enter your circuit.

3.6.2 First Program

Let’s have a look at the following circuit: a parallel connection of two switches.

Circuit diagram

How a circuit is represented in a circuit diagram

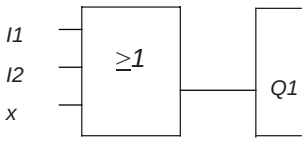


Switch S1 or switch S2 switches on E1. With IDEC SmartRelay, the parallel connection of the switches is an OR block because S1 or S2 switches the output on.

Translated into the IDEC SmartRelay program, this means: Relay K1 (in IDEC SmartRelay via output Q1) is controlled by an OR block.

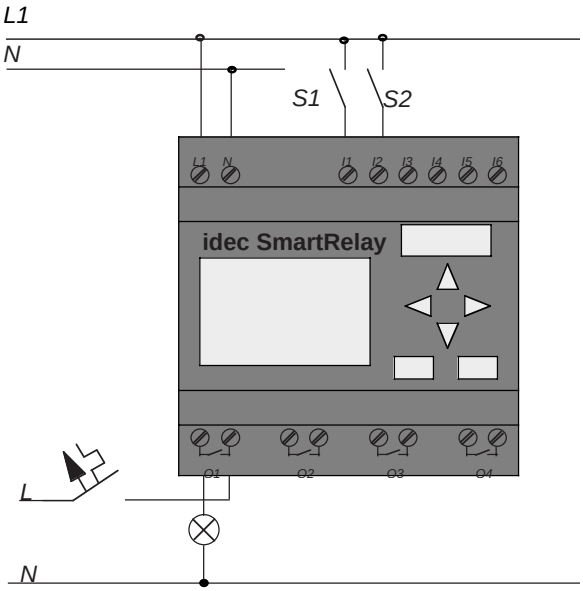
Program

I1 and I2 are connected to the input of the OR block, S1 to I1 and S2 to I2.
Thus, the program in IDEC SmartRelay looks like this:



Wiring

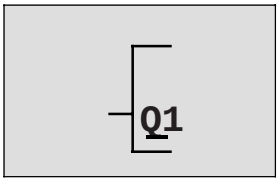
The wiring is as follows:



Switch S1 acts on input I1 and switch S2 on input I2. E1 is connected to relay Q1.

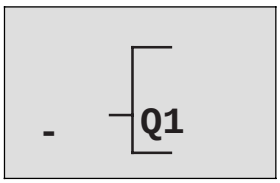
3.6.3 Entering a Program

Let's enter the program now (from the output to the input). Initially, IDEC SmartRelay displays the output:



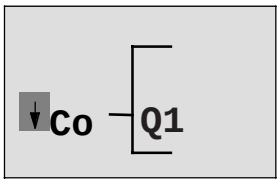
IDEC SmartRelay's first output

The Q of Q1 is underlined. This underlining is the cursor. The cursor indicates your current position in the program. You can move the cursor by pressing the ▲, ▼, ◀ and ▶ keys. Now press the key ◀. The cursor moves to the left.



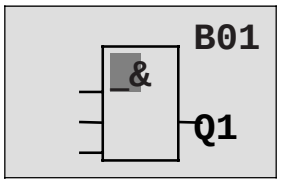
The cursor indicates your position in the program.

At this point, enter only the first block (the OR block). Press OK to switch to input mode.



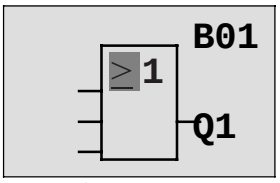
The cursor appears in the form of a solid block: you can select a connector or block.

The cursor no longer appears in the form of an underline; instead it appears as a solid block that flashes on and off. At the same time, IDEC SmartRelay offers you the first list for selection.
Select the GF list (by pressing ▼ until GF appears) and press OK. IDEC SmartRelay then displays the first block in the list of general functions (GF):



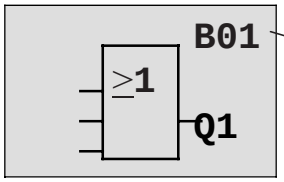
The first block in the list of general functions is AND. The cursor appears in the form of a solid block, indicating that you have to select a block.

Now press the key ▲ or ▼, until the OR block appears in the display:



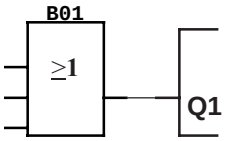
The cursor is still in the block and appears in the form of a solid block.

Press OK to conclude your selection.



Block number

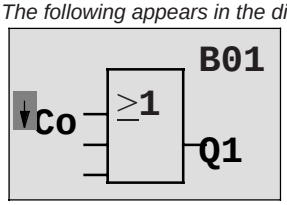
Your entire program looks like this



You have now entered the first block. Each block you enter receives a number, the block number. All you have to do now is wire the inputs of the block. To do this, proceed as follows:

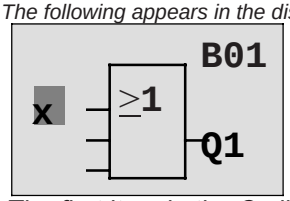
Press OK.

The following appears in the display panel

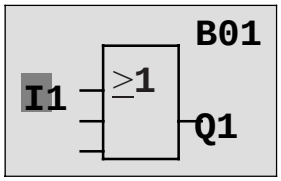


Select the Co list: Press OK

The following appears in the display panel:

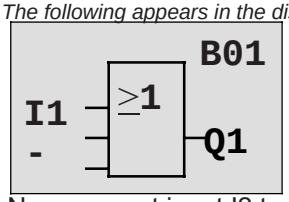


The first item in the Co list is the character for indicating that the input is not in use, an ”x”. Use the ▲ or ▼ key to select input I1.

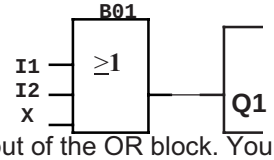


Press OK: I1 is connected to the input of the OR block. The cursor jumps to the next input of the OR block.

The following appears in the display panel



Your entire program so far looks like this in IDEC SmartRelay

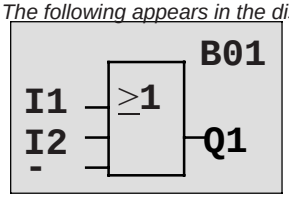


Now connect input I2 to the input of the OR block. You know how to do this already:

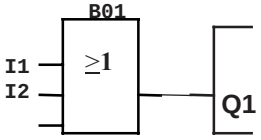
1. Switch to input mode: OK
2. Select the Co list: keys ▲ or ▼
3. Accept the Co list: OK
4. Select I2: keys ▲ or ▼
5. Accept I2: OK

Thus, I2 is now connected to the input of the OR block:

The following appears in the display panel



Your entire program so far looks like this in IDEC SmartRelay

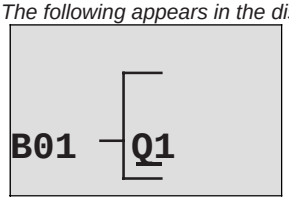


We don't need the last input of the OR block in this program. In a IDEC SmartRelay program, you mark an input that is not used with an "x", so now enter the 'x' (you know the principle already):

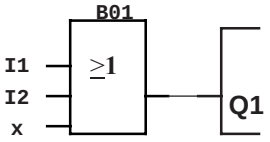
1. Switch to input mode: OK
2. Select the Co list: keys ▲ or ▼
3. Accept the Co list: OK
4. Select x: keys ▲ or ▼
5. Accept x: OK

Thus, all the block's inputs are now wired. The program is now complete. IDEC SmartRelay returns to output Q1.

The following appears in the display panel:



Your program looks like this



If you want to have another look at your first program, you can use the ◀ or ▶ key to move the cursor through the program.

But we are going to exit program input now. To do this, proceed as follows:

1. Return to the programming menu: **ESC**

If this doesn't return you to the programming menu, you have not wired a block completely. IDEC SmartRelay displays the point in the program at which you forgot something (IDEC SmartRelay only accepts completed programs). Also refer to page 3-33.

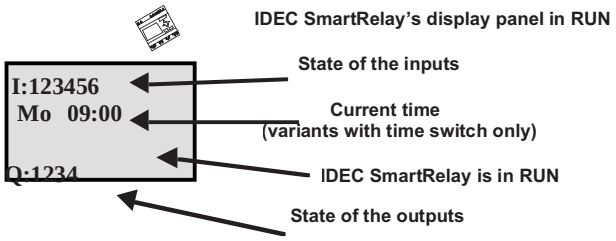
Note
IDEC SmartRelay has now stored your program permanently, so that it will not be lost in the event of a power failure. The program is stored in IDEC SmartRelay until you expressly delete it by entering the appropriate command.

2. Return to the main menu: **ESC**

Switching IDEC SmartRelay to RUN

3. Move '>' to 'Start': keys ▲ or ▼
4. Accept Start: OK

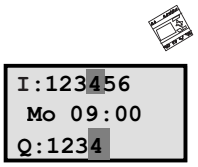
IDEC SmartRelay switches to RUN. In RUN IDEC SmartRelay displays the following:



What does "IDEC SmartRelay is in RUN?" mean?

In RUN, IDEC SmartRelay executes the program. First of all it reads the states of the inputs, uses the program you have specified to determine the states of the outputs, and switches the relays at the outputs on or off.

IDEC SmartRelay represents the state of an input or output as follows:

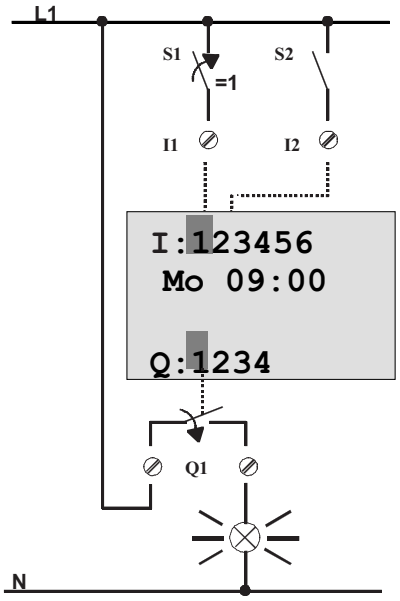


Input/output has the state '1': inverse

Input/output has the state '0': not inverse

State display

Let's have a look at that in our example:



When switch S1 is closed, voltage is applied to input I1, which has the state '1'. IDEC SmartRelay calculates the state of the outputs with the program.

Output Q1 has the state '1' here.

When Q1 has the state '1' IDEC SmartRelay operates relay Q1 and the consumer at Q1 is supplied with voltage.

The next step

You have now successfully entered your first circuit.
In the next section, we will show you how to make changes to existing programs and use special functions in them.

3.6.4 Second Program

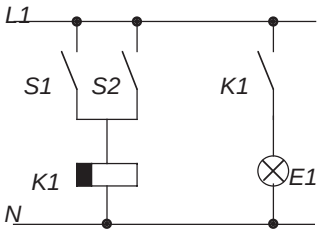
We will use the second program to show you the following:

- How to insert a block in an existing program.
- How to select a block for a special function.
- How to enter parameters.

Changing circuits

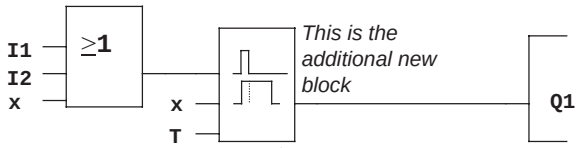
In order to produce the second program, we have to modify the first one slightly.

Let's begin by looking at the circuit diagram for the second program:



You already know the first part of the circuit. Switches S1 and S2 operate a relay. This relay switches on consumer E1 and switches it off after a delay of 12 minutes.

In IDEC SmartRelay the program looks like this:



This is the additional new block

You will recognize the OR block and output relay Q1 from the first program. Only the off delay is new.

Editing a program

Switch IDEC SmartRelay to programming mode

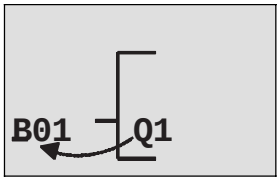
To do this, proceed as follows:

1. Switch IDEC SmartRelay to programming mode:
   (◀, ▶ and OK at the same time).
2. Select ”Program..” from the main menu
   (by moving ’>’ to “Program..” and press OK)
3. Select ”Edit Prg..” from the programming menu
   (by moving ’>’ to “Edit Prg..” and press OK)

You can now modify the existing program.

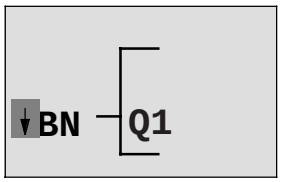
Inserting an additional block in a program

Move the cursor to the B of B01 (B01 is the block number of the OR block).



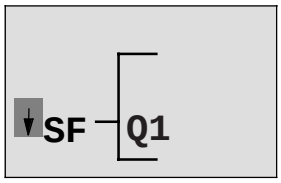
Move the cursor:
Press ◀

At this point we insert the new block. Press OK.



IDEC SmartRelay displays the BN list.

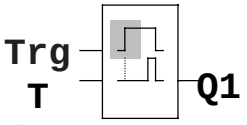
Select the SF list (B key).



The SF list contains the blocks for the special functions.

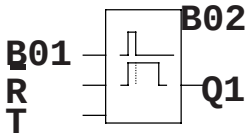
Press OK.

The block of the first special function appears:



When you select a block for a special or general function, IDEC SmartRelay displays the block of the function. The cursor is in the block and appears in the form of a solid block. Use the ▲ or ▼ key to select the block you want.

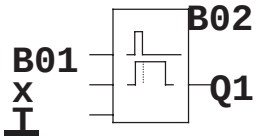
Select the desired block (off delay, see next diagram) and press OK:



The inserted block receives the block number B02. Block B01, which has been connected up to now to Q1, is automatically connected to the uppermost input of the inserted block. The cursor is positioned at the uppermost input of the inserted block.

The off–delay block has 3 inputs. The uppermost input is the trigger input (Trg). Use this input to start the off delay. In our example, the off delay is started by the OR block B01. Reset the time and outputs using the reset input and set the time for the off delay using the T parameter.
In our example, we don't use the reset input of the off delay. We wire it with 'x'. You learned how to do this in the first program, but just to remind you, here is the procedure again:

1. Position the cursor under the R: key ▲ or ▼
2. Switch to input mode: OK
3. Select the Co list: keys ▲ or ▼
4. Accept the Co list: OK
5. Select x: keys ▲ or ▼
6. Accept x: OK



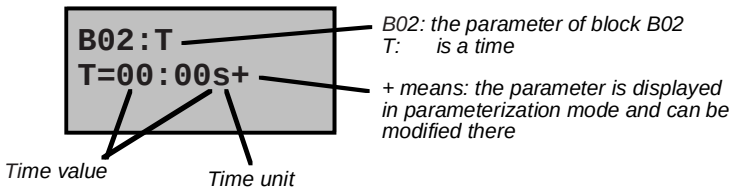
The display should now look like this:

Parameterizing a block

Now enter the time T for the off delay:

1. If the cursor is not yet under the T, move it there: keys ▲ or ▼
2. Switch to input mode: OK

IDEC SmartRelay displays the parameter window for parameters:


B02:T
T=00:00s+
B02: the parameter of block B02
T: is a time
+ means: the parameter is displayed in parameterization mode and can be modified there
Time value
Time unit

The cursor appears on the first position of the time value.

To change the time value, proceed as follows:

- Use the keys ◄ and ► to move the cursor to different positions.
- Use the keys ▲ and ▼ to change the value.
- When you have entered the time value, press OK.

Setting the time

Set the time T = 12:00 minutes:

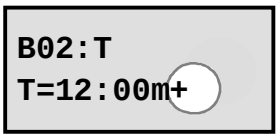
1. Move the cursor to the first position:
   ◄ or ►
2. Select ’1’:
   ▲ or ▼
3. Move the cursor to the second position:
   ◄ or ►
4. Select ’2’:
   ▲ or ▼
5. Move the cursor to the unit:
   ◄ or ►
6. Select the unit m for minutes:
   ▲ or ▼

Displaying/hiding parameters - type of protection

If you don't want the parameter to be displayed in parameterization mode, proceed as follows:

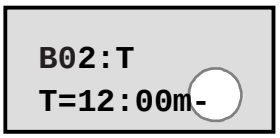
7. Move the cursor to the protection mode::
   ◄ or ►
8. Select protection mode '-':
   ▲ or ▼

The following message should now appear on the display:



Type of protection +
T can be changed in parameterization mode

or



Type of protection -
T cannot be changed in parameterization mode

9. Conclude your input:
   OK

Checking the program

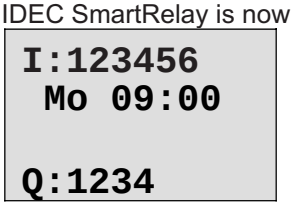
This branch of the program for Q1 is now complete. IDEC SmartRelay displays the Q1 output. You can have another look at the program on the display. Use the keys to move through the program. Use ◄ or ► to move from block to block and use ▲ and ▼ to move between the inputs on a block.

Exiting programming mode

Exit program input in the same way you did for the first program, but just remind you, here is the procedure again:

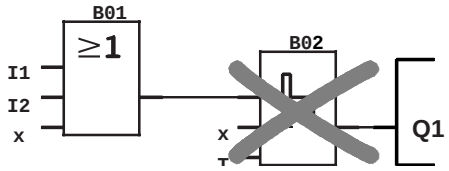
1.	Return to the programming menu:	ESC
2.	Return to the main menu:	ESC
3.	Move '>' to 'Start':	keys ▲ or ▼
4.	Accept Start:	OK

IDEC SmartRelay is now in RUN again:



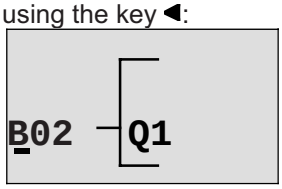
3.6.5 Deleting a Block

Let's suppose you want to delete block B02 from the following program and connect B01 directly with Q1.



To do this, proceed as follows:

1. Switch IDEC SmartRelay to programming mode (3–finger grip).
2. Select 'Edit Prg' by pressing **OK.**
3. Position the cursor at the input of Q1, i.e. under B02 using the key ◀:

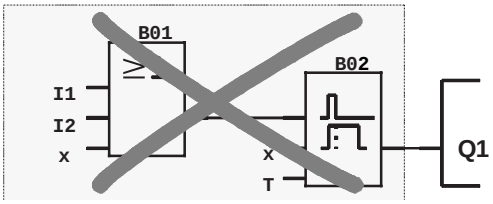


4. Press **OK.**
5. Connect block B01 instead of block B02 directly to output Q1:
   Select the BN list and press OK
   Select B01 and press OK.

Result: Block B02 is now deleted, because it is no longer used anywhere within the entire circuit. Block B01 is now connected directly to the output instead of B02.

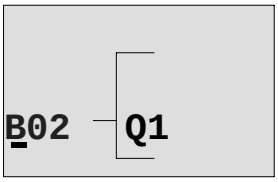
3.6.6 Deleting a Number of Interconnected Blocks

Let's suppose you want to delete blocks B01 and B02 from the following program.



To do this, proceed as follows:

1. Switch IDEC SmartRelay to programming mode (3–finger grip).
2. Select 'Edit Prg' by pressing **OK.**
3. Position the cursor at the input of Q1, i.e. under B02:



4. Press **OK.**
5. Set the connector x instead of block B02 at the Q1 output:
   Select the Co list and then press **OK.**
   Select x and then press **OK**.

Result: Block B02 is now deleted, because it is no longer used anywhere within the entire circuit. and all the blocks that are connected to it are deleted (i.e. block B01 in the example).

3.6.7 Correcting Typing Errors

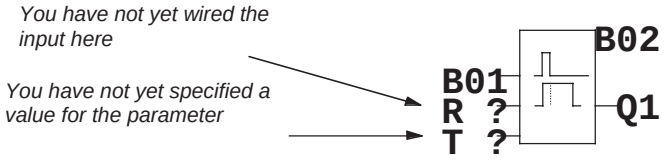
It is easy to correct typing errors in IDEC SmartRelay:

- If you have not yet concluded input, you can use **ESC** to go back a step.
- If you have already concluded input, simply start again, as follows:
  1. Move the cursor to the location of the error.
  2. Switch to input mode: **OK**
  3. Enter the correct wiring for the input.

You can only replace one block with another if the new block has exactly the same number of inputs as the old one. However, you can delete the old block and insert a new one. You can insert whichever block you like.

3.6.8 ”?” on the Display

If you have entered a program and want to exit “Edit Prg” with **ESC**, IDEC SmartRelay checks whether you have wired all the inputs of all the blocks correctly. If you have forgotten an input or parameter, IDEC SmartRelay displays the first place at which you have forgotten something and marks with a question mark all those inputs and parameters that have not been wired.

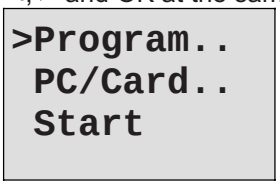


Wire the input and enter a value for the parameter. You can then exit “Edit Prg” by pressing **ESC**.

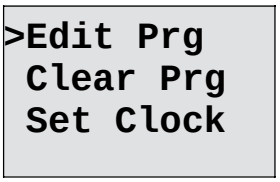
3.6.9 Deleting a Program

To delete a program, proceed as follows:

1. Switch IDEC SmartRelay to programming mode:
   ◀, ▶ and OK at the same time

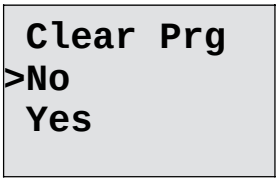


2. Move the '>' with the keys ▲ or ▼ to 'Program..' and press OK



IDEC SmartRelay switches to the programming menu.

3. Move the '>' to "Clear Prg":
   ▲ or ▼
4. Accept 'Clear Prg':
   OK



To prevent you from inadvertently deleting the program, we have included an additional query.

If you do not want to delete the program, leave the '>' on 'No' and press **OK**.

If you are sure that you want to delete the program stored in IDEC SmartRelay, proceed as follows:

5. Move the '>' to Yes:
   ▲ or ▼
6. Press OK. IDEC SmartRelay deletes the program.

3.7 Storage Space and Size of a Circuit

A program (control program in IDEC SmartRelay, circuit diagram) has the following limitations:

- The number of blocks connected in series (nesting depth)
- The storage space (use of memory by the blocks)

Memory area

You can only use a limited number of blocks for your program in IDEC SmartRelay. In addition, some blocks require extra memory for their special functions.

The memory required for special functions is divided up into 4 memory areas.

- Par: The area in which IDEC SmartRelay stores the desired values (e.g. the limit values of a counter).
- RAM: The area in which IDEC SmartRelay stores the current actual values (e.g. the counter status).
- Timer: The area IDEC SmartRelay uses for time functions such as the off delay.
- REM: The area in which IDEC SmartRelay stores actual values that have to be retained (e.g. the count value of an operating hours counter). In blocks with selective use of the retentive feature, this memory area is only used if the retentive feature is switched on.

Resources available in IDEC SmartRelay

The maximum amount of resources that can be occupied by a program in IDEC SmartRelay is as follows:

Blocks	Par	RAM	Timer	REM	Markers
56	48	27	16	15	8

IDEC SmartRelay monitors memory utilization, and displays in the function lists only those functions for which there is still enough memory space available.

Memory utilization

The table gives you an overview of the special memory requirements of the special functions:

Function block	Par	RAM	Timer	REM
Latching relay*	0	(1)	0	(1)
Current impulse relay*	0	(1)	0	(1)
Interval time–delay relay	1	1	1	0
Edge–triggered interval time–delay relay	1	1	1	0
On delay	1	1	1	0
Off delay	2	1	1	0
On/off delay	2	1	1	0
Retentive on delay	2	1	1	0
Seven–day time switch	6	2	0	0
Twelve-month time switch	2	0	0	0
Up/down counter*	2	(2)	0	(2)
Operating hours counter	2	0	0	4
Symmetrical clock pulse generator	1	1	1	0
Asynchronous pulse generator	3	1	1	0
Random generator	2	1	1	0
Frequency trigger	3	3	1	0
Analog trigger	4	2	0	0
Analog comparator	3	4	0	0
Stairwell light switch	1	1	1	0
Dual–function switch	2	1	1	0
Message texts	1	0	0	0

* Depending on the parameterization of the function with or without retentivity, each function occupies the following amount of memory:

- Retentivity switched off: RAM memory
- Retentivity switched on: REM memory

The maximum number of functions that can be used:

The memory requirements of individual special functions determine the maximum number of special functions you can use.

Example: The operating hours counter requires 2 memory areas for desired value storage (Par) and 4 memory areas for the actual values that have to be retained (REM). There are 15 REM memory areas and 48 Par memory areas In IDEC SmartRelay.

The special function of the operating hours counter can therefore only be used a maximum of 3 times, leaving just 3 REM memory areas left. Although there are still 42 Par memory areas free, you are one REM memory area short to run an additional operating hours counter.

Calculation: Free memory areas divided by the required number of memory areas. Carry out this calculation for each memory area required (Par, RAM, timer, REM). The lowest value shows you the maximum number of functions you can use.

Nesting depth

A program path consists of a series of function blocks starting and ending with a terminal block. The number of blocks in a program path describes the nesting depth.

Inputs and levels (I, Ia, hi, lo), as well as outputs and markers (Q, Qa, M) are terminal blocks . The terminal blocks are not represented by a block symbol in IDEC SmartRelay.

The maximum number of function blocks you can use in IDEC SmartRelay is 56, so the maximum nesting depth is: 56 function blocks + 2 terminal blocks = 58.

4 IDEC SmartRelay Functions

Element lists

IDEC SmartRelay offers you a number of elements in programming mode. So that you don't lose track of things, we have divided these elements into lists. These lists are:

- ±Co: List of connectors (Connector)
  (see Section 4.1)
- ±GF: List of the general functions AND, OR, ...
  (see Section 4.2)
- ±SF: List of special functions
  (see Section 4.4)
- ±BN: List of the completed and reusable blocks in the circuit

Contents of the lists

All the lists display elements available in IDEC SmartRelay. Normally, these are all the connectors, all the general functions and all the special functions that the respective IDEC SmartRelay variant knows. These elements also include all the blocks you have created in IDEC SmartRelay before you call up the ±BN list.

When IDEC SmartRelay no longer displays everything

IDEC SmartRelay no longer displays all elements if:

- No further block must be inserted.
  In this case, there is either no more memory available or the maximum number of possible blocks has been reached (56).
- A special block would use more memory than is still available in IDEC SmartRelay.
- The resulting number of function blocks connected in series would exceed 7 (see Section 3.7).

4.1 Constants and Connectors - Co

Constants and connectors (connectors = Co) are inputs, outputs, memory markers and fixed voltage levels (constants).

Inputs

Inputs are identified by the letter **I**. The input numbers (I1, I2, ...) correspond to the numbers of the input connectors on IDEC SmartRelay.

Analog inputs

The IDEC SmartRelay models FL1A-H12SND, FL1A-H12RCE and FL1A-B12RCE include the inputs I7 and I8, which can also be used as AI1 and AI2, depending on how they are programmed. If the inputs are used as I7 and I8, the signal applied is interpreted as a digital value. If they are used as AI1 and AI2, the signals are interpreted as analog values. In the case of special functions, which can only be effectively connected with analog inputs on the input side, only the analog inputs AI1 and AI2 are offered for selection in programming mode when the input signal is selected.

Outputs

Outputs are identified by the letter **Q**. The output numbers (Q1, Q2, ...) correspond to the numbers of the output connectors on IDEC SmartRelay.

Markers

Markers are identified by the letter **M**. Markers are virtual outputs that have the same value at their output as they have at their input. There are 8 memory markers (M1 ... M8) available in IDEC SmartRelay.

By using memory markers you can exceed the maximum number of consecutive blocks.

Startup flags

Memory marker M8 is set in the first cycle of the user program and can be used subsequently in your program as a startup flag. It is automatically reset after the first cycle of program processing.

In setting, deletion and evaluation, memory marker M8 can be used in the same way as memory markers M1 to M7 in all subsequent cycles.

Note
The signal applied at the marker's output is always that of the last program cycle. The signal is not changed within a program cycle.

Levels

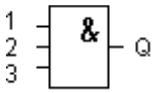
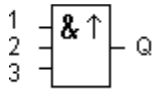
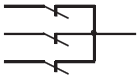
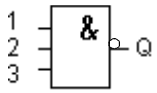
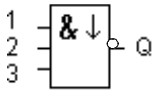
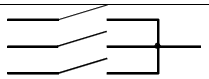
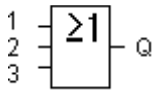
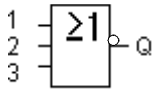
Voltage levels are identified by **hi** and **lo**. If a block is supposed to have the state “1” = hi or “0” = continuously, the input is wired with the fixed level or the constant hi or lo value.

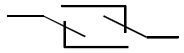
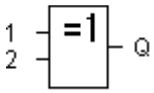
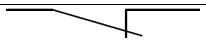
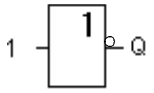
Open connectors

If a connector pin of a block is not to be wired, this is indicated with an **x**.

4.2 List of General Functions - GF

General functions are basic operation links in Boolean algebra.
When you enter a circuit, you will find the blocks for general functions in the GF list. The following general functions exist:

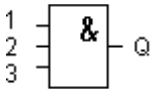
Circuit diagram representation	Representation in IDEC SmartRelay	Designation of the general function
Series connection of normally open contacts		AND (see page 4-6)
		AND with RLO edge detection (see page 4-6)
 **Parallel connec - tion of normally closed contacts**		NAND (AND not) (see page 4-7)
		NAND with RLO edge detection (see page 4-8)
 **Parallel connec - tion of normally open contacts**		OR (see page 4-8)
Series connec - tionof normally closed contacts		NOR (OR not) (see page 4-9)

Circuit diagram representation	Representation in IDEC SmartRelay	Designation of the general function
 **Double change-over**		XOR (exclusive OR) (see page 4-10)
 **Inverter**		NOT (negation, inverter) (see page 4-10)

4.2.1 AND

The series connection of a number of normally open contacts is represented in a circuit diagram as follows:

Symbol in IDEC SmartRelay:



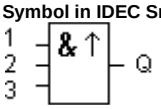
The output of the AND only adopts the state 1 if **all** the inputs have the state 1 (i.e. they are closed).
If an input pin of this block is not wired (x), then the following applies to the input: x = 1.

Logic table for AND

1	2	3	Q
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

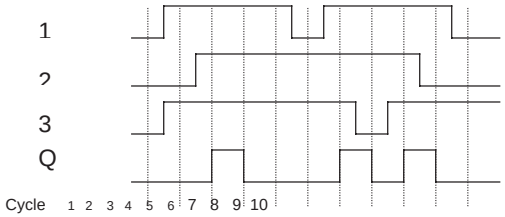
4.2.2 AND with RLO Edge Detection

Symbol in IDEC SmartRelay:



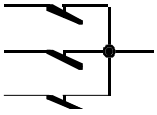
The output of AND with RLO edge detection only adopts the state 1 when **all** inputs have the state 1 and **at least one** input had the state 0 in the previous cycle.
If an input pin of this block is not wired (x), then the following applies to the input: x = 1.

Timing diagram for AND with RLO edge detection

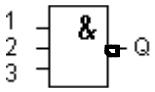


4.2.3 NAND (AND Not)

The parallel connection of a number of normally closed contacts is represented in a circuit diagram as



Symbol in IDEC SmartRelay:



The output of NAND only adopts the state 0 if **all** the inputs have the state 1 (i.e. they are closed).

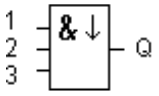
If an input pin of this block is not wired (x), then the following applies to the input: x = 1.

Logic table for NAND

1	2	3	Q
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

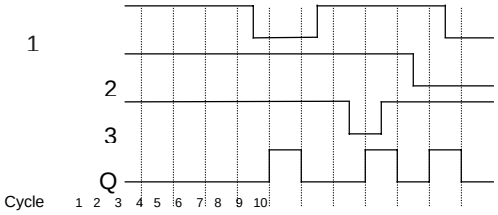
4.2.4 NAND with RLO Edge Detection

Symbol in IDEC SmartRelay:



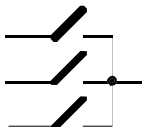
The output of NAND with RLO edge detection only adopts the state 1 when **at least one** input has the state 0 and **all** inputs had the state 1 in the previous cycle.
If an input pin of this block is not wired (x), then the following applies to the input: x = 1.

Timing diagram for NAND with RLO edge detection

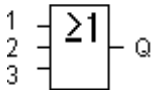


4.2.5 OR

The parallel connection of a number of normally open contacts is represented in a circuit diagram as follows:



Symbol in IDEC SmartRelay:



The output of the OR adopts the state 1 if **at least one** input has the state 1 (i.e. it is closed).
If an input pin of this block is not wired (x), then the following applies to the input: x = 0.

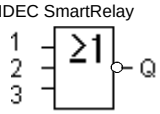
Logic table for OR:

1	2	3	Q
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

4.2.6 NOR (OR Not)

The series connection of a number of normally closed contacts is represented in a circuit diagram as follows:

Symbol in IDEC SmartRelay



The output of NOR only adopts the state 1 if **all** the inputs have the state 0 (i.e. they are switched off). As soon as any of the inputs is switched on (state 1), the output of NOR is set to 0.

If an input pin of this block is not wired (x), then the following applies to the input: x = 0.

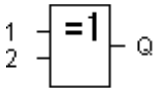
Logic table for NOR

1	2	3	Q
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

4.2.7 XOR (Exclusive OR)

An XOR in a circ. it diagram is a series connection of two change over contacts:

Symbol in IDEC SmartRelay:



The output of XOR adopts the state 1 if the inputs have **different** states.

If an input pin of this block is not wired (x), then the following applies to the input: x = 0.

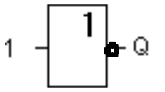
Logic table for XOR

1	2	Q
0	0	0
0	1	1
1	0	1
1	1	0

4.2.8 NOT (Negation, Inverter)

A normally closed contact is sented in a circuit diagram as

Symbol in IDEC SmartRelay:



The output adopts the state 1 if the input has the state 0. In other words, NOT inverts the state at the input.

The advantage of the NOT function can be illustrated by the following example: you no longer require normally closed contacts for IDEC SmartRelay. You use a normally open contact and convert it into a normally closed contact by using NOT.

Logic table for NOT

1	Q
0	1
1	0

4.3 Fundamentals of Special Functions

You will notice that special functions differ from general functions because of the differences in their input descriptions. Special functions include time functions, retentivity and various parameterization options to adapt the program to your individual requirements.

In this section we would like to give you a brief overview of the input descriptions and provide you with some important background information about special functions. The individual special functions are described in Section 4.4.

4.3.1 Description of the Inputs

Connection inputs

The connections that can be made to other blocks or to the inputs of the IDEC SmartRelay device are described here.

- **S (set):**
  The input S allows you to set the output to “1”.
- **R (reset):**
  The reset input R takes priority over all other inputs and switches outputs to “0”.
- **Trg (trigger):**
  Use this input to start the execution of a function.
- **Cnt (count):**
  This input records count pulses.
- **Fre (frequency):**
  Frequency signals to be evaluated are applied at the input with this description.
- **Dir (direction):**
  Use this input to set the direction in which a counter should count, for example.
- **En (enable):**
  This input enables the function of the block. If the input is at “0”, other signals are ignored by the block.
- **Inv (invert):**
  The output signal of the block is inverted when this input is activated.

- **Ral (reset all):**
  All internal values are reset.

Connector X at the inputs of the special functions

If you wire inputs of special functions to the x connector, these inputs will be assigned the value 0 i.e. a low signal is applied to the inputs.

Parameter inputs

There some inputs at which you do not apply signals. Instead, you parameterize the function block with certain values.

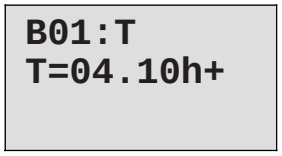
- **Par (parameter):**
  This input is not wired. Set parameters for the block.
- **T (time):**
  This input is not wired. Set times for a block.
- **No (number):**
  This input is not wired. Set time bases.
- **P (priority):**
  This input is not wired. Set priorities.

4.3.2 Time Response

Parameter T

With some of the special functions it is possible to parameterize a time value T. When specifying the time, note that the values to be entered depend on the time base set:

Time Base	_ _ : _ _
s (seconds)	Seconds : $^{1}/_{100}$ seconds
m (minutes)	Minutes : Seconds
h (hours)	Hours : Minutes



Setting the time T for 250 minutes:
Unit hours (h):

04.00 hours	240 minutes
00.10 hours	+10 minutes
	=250 minutes

Note
Always specify a time T ≥ 0.10 s. For T = 0.05 s and T = 0.00 s the time T is not defined.

Accuracy of T

All electronic components have clock/minute differences. This can result in deviations in the set time (T). In IDEC SmartRelay the maximum deviation is 1 %.

Example:

In 1 hour (3600 seconds) the deviation is 1 % (i.e. 36 seconds).

In 1 minute the deviation is therefore only 0.6 seconds.

Accuracy of the time switch

To ensure that this deviation doesn't result in the clock running inaccurately in C variants, the time switch is regularly compared with a high–precision time base and adjusted accordingly.

This results in a maximum time error of ±5s a day.

4.3.3 Clock Buffering

The internal clock of a IDEC SmartRelay module has a power buffer and continues to run if there is a power failure. The ambient temperature affects the duration of the reserve power. At an ambient temperature of 25°C the typical power buffer is 80 hours.

4.3.4 Retentivity

The switching states and counter values can be kept retentively in the special functions. To do this, retentivity must be switched on for the relevant function.

4.3.5 Degree of Protection

The parameter protection setting allows you to specify whether the parameters can be displayed and altered in parameter assignment mode on the IDEC SmartRelay module.

There are two possible settings:

+: The parameter settings are also displayed in parameter assignment mode and can be changed.

-: The parameter settings are not displayed in parameter assignment mode and can only be changed in programming mode.

4.3.6 Gain and Offset Calculation for Analog Values

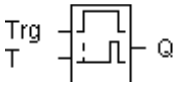
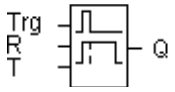
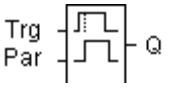
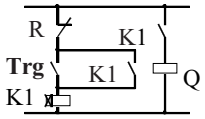
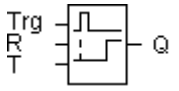
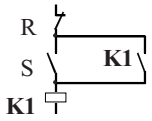
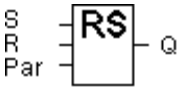
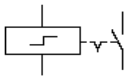
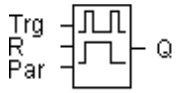
The Gain and Offset parameters allow the internal representation of an analog value to be aligned with the actual measured value.

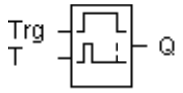
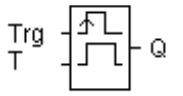
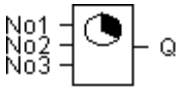
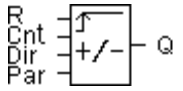
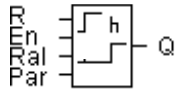
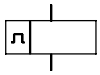
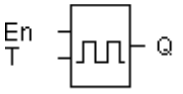
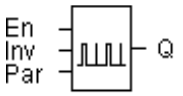
Parameter	Minimum	Maximum
Connector voltage (in V)	0	≥ 10
Internal process image	0	1000
Gain (in %)	0	1000
Offset	-999	+999

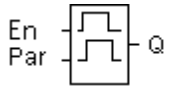
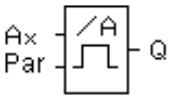
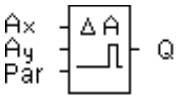
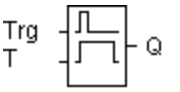
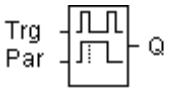
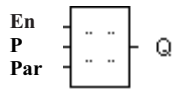
A connector voltage of 0 to 10 V is mapped internally to values of 0 to 1000. A connector voltage greater than 10 V is also represented as 1000 in the internal process image.
For example, you can use the Gain parameter to set a gain of 1000 % (a factor of 10).
You can use the Offset parameter to move the zero point of the measured values.
You will find a sample application in the description of the “analog comparator” special function on page 4-53.
For information on the analog inputs, see also Section 4.1.

4.4 List of Special Functions - SF

When you enter a program in IDEC SmartRelay, you will find the blocks for the special functions in the SF list. In the following table you will also find comparable representations from circuit diagrams as well as an indication as to whether the function in question has parameterizable retentivity.

Circuit diagram representation	Representation in IDEC SmartRelay	Description of the special function	Re
		On delay (see page 4-18)	
		Off delay (see page 4-20)	
		On/off delay (see page 4-22)	
		Retentive on delay (see page 4-24)	
		Latching relay (see page 4-26)	Re
		Current impulse relay (see page 4-28)	Re

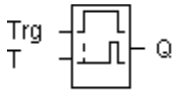
Circuit diagram representation	Representation in IDEC SmartRelay	Description of the special function	Re
		Interval time-delay relay (see page 4-29)	
		Edge–triggered interval time-delay relay (see page 4-30)	
		Seven–day time switch (see page 4-31)	
		Twelve–month time switch (see page 4-36)	
		Up and down counter (see page 4-38)	Re
		Operating hours counter (see page 4-41)	
		Symmetrical clock pulse generator (see page 4-44)	
		Asynchronous pulse generator (see page 4-45)	

Circuit diagram representation	Representation in IDEC SmartRelay	Description of the special function	Re
		Random generator (see page 4-46)	
		Frequency trigger (see page 4-48)	
		Analog trigger (see page 4-50)	
		Analog comparator (see page 4-53)	
		Stairwell light switch (see page 4-57)	
		Dual–function switch (see page 4-59)	
		Message texts (see page 4-61)	

4.4.1 On Delay

Brief description

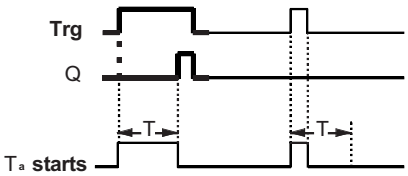
If the on delay is selected, the output is not switched over until a definable time period has elapsed.

Symbol in IDEC SmartRelay:	Connection	Description
	Input Trg	Use Trg (trigger) input to start the time for the on delay.
	Parameter T	T is the time after which the output is switched on (output signal is switched from 0 to 1).
	Output Q	Q switches on after expiration of the defined time T if Trg is still set.

Parameter T

Please note the parameter values for the T parameter in Section 4.3.2.

Timing diagram



The bold part of the timing diagram ap - pears in the on-delay symbol.

Description of function

When the state at the Trg input changes from 0 to 1, the time T_a begins to elapse (T_a is the current time in IDEC SmartRelay).

If the state at the Trg input remains 1 at least for the duration of the parameterized time T, the output is set to 1 after the time T has elapsed (there is a delay between the input being switched on and the output coming on).

If the state at the Trg input switches back to 0 before the time T has elapsed, the time is reset.

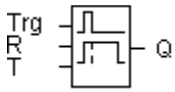
The output is reset to 0 if the state at the Trg input is 0.

In the event of a power failure, the elapsed time is reset.

4.4.2 Off Delay

Brief description

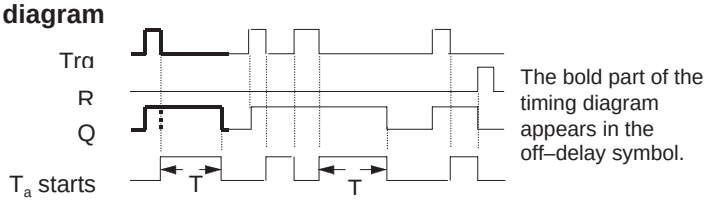
If the off delay is selected, the output is not reset until a definable time period has elapsed.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	A negative signal edge (change from 1 to 0) at the input Trg (trigger) starts the off–delay timer
	Input R	The input R resets the elapsed time for the off delay and sets the output to 0.
	Parameter T	T is the period after which the output is switched off (output signal is switched from 1 to 0).
	Output Q	Q switches on when Trg does but remains on when Trg switches off, until the delay period T has elapsed.

Parameter T

Please note the parameter values for the T parameter in Section 4.3.2.

Timing diagram



Description of function

When the state at the input Trg changes to 1, the output Q switches to 1 immediately.

If the state at the input Trg changes from 1 to 0, the current time T_a starts in IDEC SmartRelay, and the output remains set. If T_a reaches the values specified via T (T_a=T), the output Q is reset to 0 (off delay).

If the Trg input switches on and off again, the time T_a starts again.

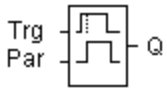
The input R (Reset) resets the elapsed time T_a and the output before the set time delay T_a has elapsed.

In the event of a power failure, the elapsed time is reset.

4.4.3 On/Off Delay

Brief description

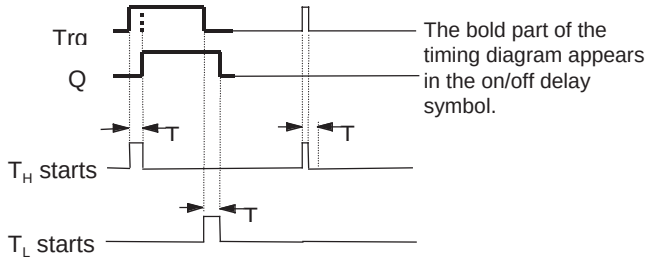
If the on/off delay is selected, the output is switched through after a programmable time and reset after a parameterizable time period has elapsed.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	A rising edge (change from 0 to 1) at the input Trg (Trigger) starts the time T_H for the on delay. A falling edge (change from 1 to 0) starts the time T_L for the off delay.
	Parameter Par	T_H is the time after which the output is switched on (output signal is switched from 0 to 1). T_L is the time after which the output is switched off (output signal is switched from 1 to 0).
	Output Q	Q switches on after the parameterized time T_H has elapsed if Trg is still set, and switches off after the time T_L has elapsed if Trg has not been set again in the interim.

Parameters T_H and T_L

Note the default values for the parameters T_H and T_L in Section 4.3.2.

Timing diagram



Description of function

When the state at the input Trg changes from 0 to 1, the timed period T_H elapses.

If the state at the input Trg remains 1 at least for the duration of the parameterized time T_H, the output is set to 1 after the time T_H has elapsed (there is a delay between the input being switched on and the output coming on).

If the state at the input Trg switches back to 0 before the time T_H has elapsed, the time is reset.

When the state at the input changes to 0 again, the timed period T_L elapses.

If the state at the input Trg remains at 0 at least for the duration of the parameterized time T_L, the output is set to 0 after the time T_L has elapsed (there is a delay between the input being switched off and the output going off).

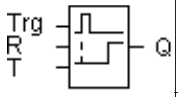
If the state at the input Trg switches back to 1 before the time T_L has elapsed, the time is reset.

In the event of a power failure, the elapsed time is reset.

4.4.4 Retentive On Delay

Brief description

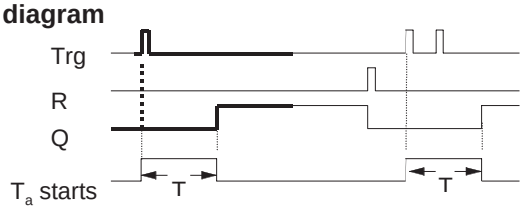
Following an input pulse, a definable timed period starts. The output is set when the time has elapsed.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	Use the Trg (trigger) input to start the time for the on delay.
	Input R	Input R resets the time for the on delay and sets the output to 0.
	Parameter T	T is the time after which the output is switched on (output state is switched from 0 to 1).
	Output Q	Q is switched on when the delay period T has elapsed.

Parameter T

Please refer to the note in Section 4.3.2 when specifying the values.

Timing diagram



The bold part of the timing diagram appears in the retentive on–delay

Description of function

When the state at the Trg input changes from 0 to 1, the current time T_a starts. When T_a reaches the time T, output Q is set to 1. Another switching operation at the Trg input has no effect on T_a.

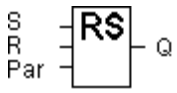
The output and the time T_a are not reset to 0, until the state of the R input changes to 1 again.

In the event of a power failure, the elapsed time is reset.

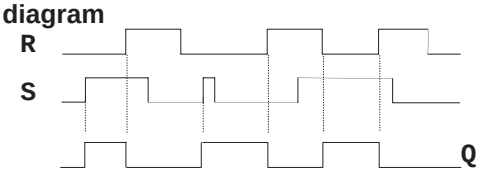
4.4.5 Latching Relay

Brief description

The output Q is set via the input S. The output is reset via the input R.

Symbol in IDEC SmartRelay	Connection	Description
	Input S	Input S sets the output Q to 1.
	Input R	The input R resets the output Q to 0. If S and R are both 1 at the same time, then the output is reset
	Parameter Par	This parameter is used to switch retentivity on or off. Rem: off = no retentive feature on = the state can be stored retentively
	Output Q	Q switches on when S does and remains on until the input R is set.

Timing diagram



Switching behavior

A latching relay is a simple binary memory cell. The signal at the output depends on the states of the inputs and the previous state at the output. The following table illustrates the logic once more:

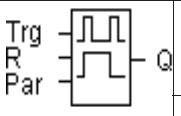
S_n	R_n	Q	Remarks
0	0	x	State remains the same
0	1	0	Reset
1	0	1	Set
1	1	0	Reset (resetting has priority over setting)

After power failure the signal that was valid before the power failure is set at the output, but only if the retentive feature was switched on.

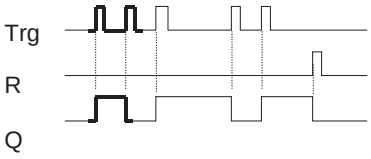
4.4.6 Current Impulse Relay

Brief description

The output is set and reset by a short pulse at the input.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	Use the Trg input (trigger) to switch the output Q on and off.
	Input R	The input R resets the current impulse relay and sets the output to 0.
	Parameter Par	This parameter is used to switch retentivity on or off. Rem: off = no retentive feature on = the state can be stored retentively
	Output Q	Q switches on when Trg is sent and remains switched on until T expires.

Timing diagram



The bold part of the timing diagram appears in the current impulse relay symbol.

Description of function

Every time the state at the input Trg changes from 0 to 1, the output Q changes its state, i.e. the output switches on or off.

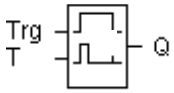
Use the R input to reset the current impulse relay to its initial state (i.e. the output is set to 0).

After power failure the current impulse relay is reset. The Q output changes to 0 if the retentive feature is not on.

4.4.7 Interval Time–Delay Relay - Pulse Output

Brief description

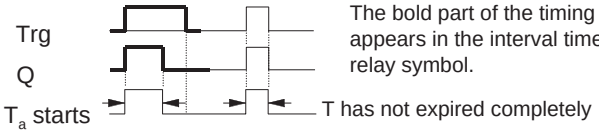
An input signal produces a signal of definable duration at the output.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	The input Trg (trigger) starts the time for the interval time–delay relay.
	Parameter T	T is the period after which the output is switched off (output signal is switched from 1 to 0).
	Output Q	Q comes on with Trg and remains on during the time Ta and while the input is set to 1.

Parameter T

Please refer to the note on the T parameter in Section 4.3.2.

Timing diagram


Trg
Q
T_a starts
The bold part of the timing diagram appears in the interval time–delay relay symbol.
T has not expired completely

Description of function

When the input Trg switches to the state 1, the output Q immediately switches to the state 1. At the same time, the elapsed time T_a starts running; the output remains set.

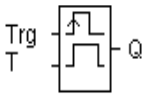
If T_a reaches the value specified by means of T (T_a=T), the output Q is reset to 0 (pulse output).

If the state at the input Trg switches back from 1 to 0 before the specified time has elapsed, the output also immediately switches back from 1 to 0.

4.4.8 Edge–Triggered Interval Time–Delay Relay

Brief description

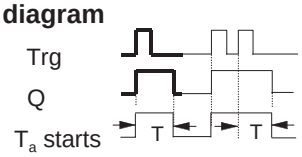
An input signal produces a signal of a parameterizable duration at the output (retriggerable).

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	The input Trg (trigger) starts the time for the edge–triggered interval time–delay relay
	Parameter T	T is the period after which the output is switched off (output signal is switched from 1 to 0).
	Output Q	Q switches on when Trg does but remains on when Trg switches off until the delay period T has elapsed.

Parameter T

Please refer to the note on the T parameter in Section 4.3.2.

Timing diagram



The bold part of the timing diagram appears in the edge–triggered interval time–delay relay symbol.

Description of function

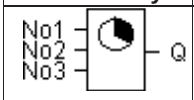
When the input Trg switches to the state 1, the output Q immediately switches to the state 1. At the same time, the time T_a starts running. If T_a reaches the time specified for T (T_a=T), the output Q is reset to 0 (pulse output).

If the input Trg changes again from 0 to 1 before the set time has elapsed (retriggering), the time T_a is reset and the output remains on.

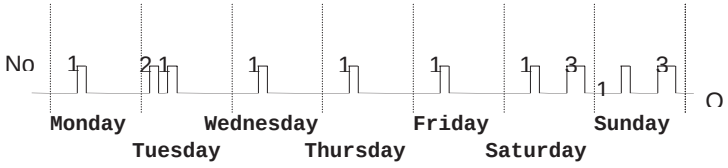
4.4.9 Seven–Day Time Switch

Brief description

The output is controlled by a definable on/off date. Every possible combination of weekdays is supported. Select the active weekdays by hiding the inactive weekdays.

Symbol in IDEC SmartRelay	Connection	Description
	Parameters No 1, No 2 No 3	The No (cam) parameter is used to set the on and off times for each of the **cams** of the seven–day time switch. You specify the times in terms of day and time.
	Output Q	Q switches on when the parameterizable cam is switched on.

Timing diagram (3 examples)



No1:	Daily:	06:30 hours to 08:00 hours
No2:	Tuesday	03:10 hours to 04:15 hours
No3:	Saturday and Sunday	16:30 hours to 23:10 hours

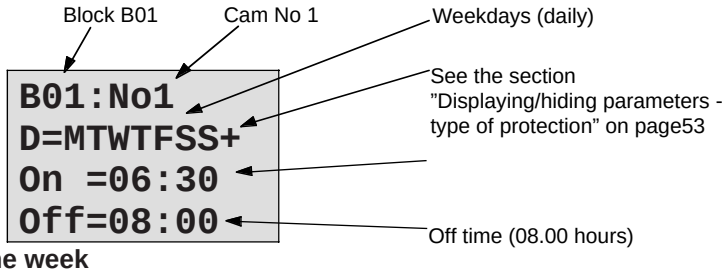
Description of function

Each seven–day time switch has three setting cams, each of which can be used to configure a time window. You use the cams to set the on and off times for the time windows. At the on times, the seven–day time switch activates the output if it is not already on.

At the off times, the seven–day time switch deactivates the output if it is not already off. If you set an on time on one cam that is the same as the off time on another cam on the seven–day time switch, then the on and off times conflict. In such cases, cam 3 has priority over cam 2 and cam 2 has priority over cam 1.

Parameter assignment window

The parameter assignment window for cam no. 1, for example, is as follows:



Day of the week

The letters after “D=” have the following meanings:

- M : Monday (Monday)
- T : Tuesday (Tuesday)
- W : Wednesday (Wednesday)
- T : Thursday (Thursday)
- F : Friday (Friday)
- S : Saturday (Saturday)
- S : Sunday (Sunday)

An uppercase letter means the weekday has been selected. A ”-” means the weekday has not been selected.

Switching times

You can set any time between 00:00 and 23:59.
- -:- - means no switching on or off.

Setting the seven–day time switch

To enter the switching times, proceed as follows:

1. Position the cursor on one of the time switch’s cam (No) parameters (e.g. No1).
2. Press OK. IDEC SmartRelay opens the parameter assignment window for the cam. The cursor is positioned on the day of the week.
3. Use the ▲ and ▼ keys to select one or more days of the week.
4. Use the ▶ key to move the cursor to the first position for the on time.
5. Set the on time.
   Use the ▲ and ▼keys to change the value. To move the cursor from one position to another, use the ◀ and ▶ keys. You can only select the value - -:- - at the first digit (- -:- - means no switching operation).
6. Use the ▶ key to move the cursor to the first position for the off time.
7. Set the off time (same procedure as for step 5).
8. Conclude your input by pressing OK.
   The cursor is positioned at parameter No 2 (cam 2). You can now parameterize another cam.

Note
Please refer to the technical specifications in Section 4.3.2 for information regarding the accuracy of the time switch.

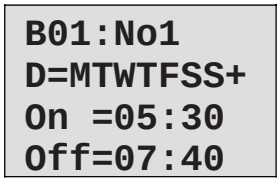
Seven–day time switch: example

The output of the seven–day time switch is to be switched on every day from 05:30 to 07:40. In addition, the output is also to be switched on from 03:10 to 04:15 on Tuesday and from 16:30 to 23:10 at the weekend.
Three cams are required for this.

Here is the parameter assignment window for cams 2 and 3 from the above timing diagram.

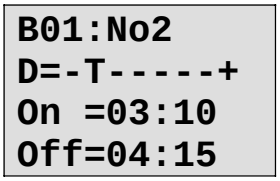
Cam 1

Cam 1 switches on the output of the seven–day time switch every day from 05:30 to 07:40.



Cam 2

Cam 2 switches on the output of the seven–day time switch every Tuesday from 03:10 to 04:15.

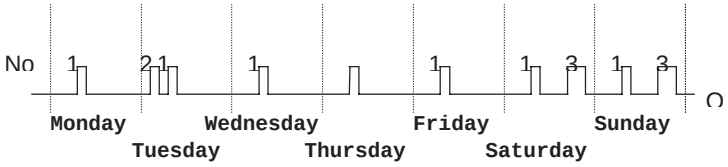


Cam 3

Cam 3 switches on the output of the seven–day time switch every Saturday and Sunday from 16:30 to 23:10.

```
B01:No3
D=-----SS+
On =16:30
Off=23:10
```

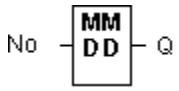
Result



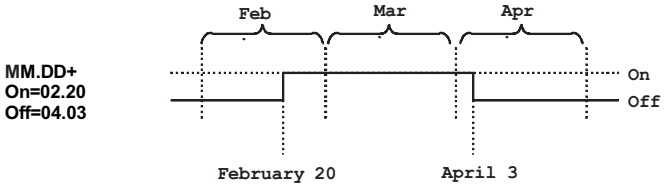
4.4.10 Twelve–Month Time Switch

Brief description

The output is controlled by a definable on/off date.

Symbol in IDEC SmartRelay	Connection	Description
	Input No	Use the No parameter to set the on and off times for the cam of the twelve–month time switch.
	Output Q	Q switches on when the parameterizable cam is switched on.

Timing diagram



Description of function

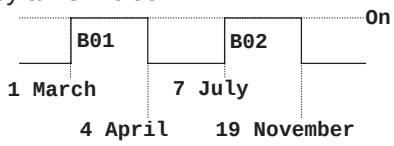
At the on time, the twelve–month time switch switches the output on and at the off time, it switches the output off. The off date indicates the date on which the output is reset to 0. The first value indicates the month, the second value indicates the day.

Parameterization example

The output of a IDEC SmartRelay has to be switched on every year on March 1 and switched off on April 4, switched on again on July 7 and switched off on November 19. For this you require 2 twelve–month time switches each of which is configured for one of the on periods. The outputs are then linked by an OR block.

B01:No
MM.DD
On=03.01
Off=04.04

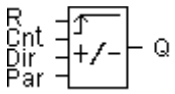
B02:No
MM.DD
On=07.07
Off=11.19



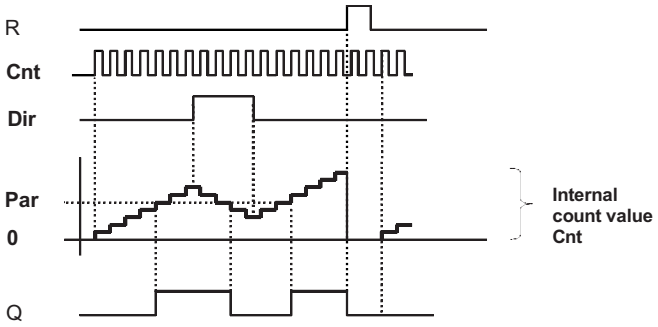
4.4.11 Up/Down Counter

Brief description

On receipt of an input pulse, an internal counter starts counting either up or down, depending on the parameters. When the definable count value is reached, the output is set. The direction of the count is set by a separate input.

Symbol in IDEC SmartRelay	Connection	Description
	Input R	The R input can be used to reset the internal count value and the output to zero.
	Input Cnt	The counter counts the changes from state 0 to state 1 at the Cnt input. Changes from state 1 to state 0 are not counted. Maximum count frequency at the input connectors: 5 Hz
	Input Dir	The Dir input allows you to specify the counting direction as follows: Dir = 0: count up Dir = 1: count down
	Parameter Par	Lim is the count threshold value; when the internal counter reaches that value, the output is set. Rem activates retentivity
	Output Q	Q switches on when the count value is reached.

Timing diagram



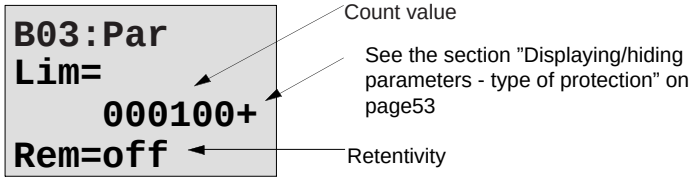
Description of function

At each positive signal edge at the input, Cnt either increases the internal counter value by one (Dir = 0) or decreases it by one (Dir = 1).

If the internal counter value is greater than or equal to the value specified for Par, the output Q is set to 1.

The Reset input R can be used to reset the internal counter value and the output to '000000'. As long as R=1, the output remains set to 0 and the pulses at the input Cnt are not counted.

Par parameter setting



If the internal counter value is greater than or equal to Par, output Q is set. The counter remains the same in the case of under or overflow.

Lim can be anything between 0 and 999999.

Rem: This parameter switches the retentive feature of the internal Cnt counter on and off.

off = No retentive feature

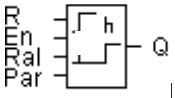
on = The Cnt counter can be stored retentively

If the retentive feature is switched on, when a power failure occurs the counter status remains the same and this value is used once power is restored.

4.4.12 Operating Hours Counter

Brief description

When the input is set, a definable timed period starts running. The output is set when the defined period has elapsed.

Symbol in IDEC SmartRelay	Connection	Description
	Input R	R = 0:Hours can be counted if Ral is not 1 Ral = 1:The counter is stopped The input R resets the output. The remaining period of the service interval MN is set to MN = MI. The previously elapsed time remains stored.
	Input En	En is the monitoring input. IDEC SmartRelay measures the length of time in which this input is set.
	Input Ral	Ral = 0: Hours can only be counted if R is not 1 Ral = 1:The counter is stopped The input Ral (Reset all) resets the counter and the output, i.e. • Output Q = 0, • Recorded operating time OT = 0 • Remaining period of service interval MN = MI.

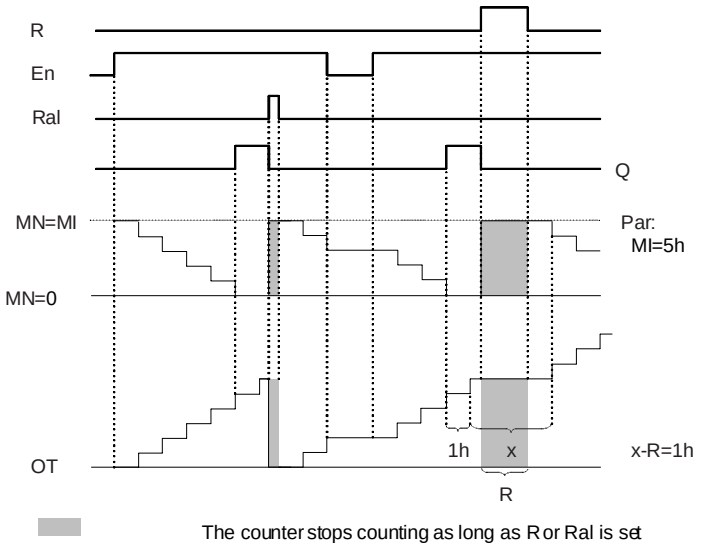
Symbol in IDEC SmartRelay	Connection	Description
	Parameter Par: MI	MI: specified service interval in hours. MI can be any number of hours in the range 0 to 9999.
	Output Q	If the remaining time MN = 0 (see timing diagram), the output is set.

MI = parameterized count value

MN= remaining time

OT = total time elapsed since the last 1 signal at the Ral input

Timing diagram



MI = Defined time period

MN= Remaining time

OT= Total elapsed time since last 1 signal at the input Ral

Description of function

The operating hours counter monitors the input En. As long as the signal 1 is present at that input, IDEC SmartRelay monitors the elapsed time and the remaining period MN. IDEC SmartRelay displays those times in parameterization mode. When the remaining period MN reaches 0, the output Q is set to 1.

The input R resets the output Q and the timer for the remaining period to the specified period MI. The internal counter OT continues to run.

The Ral input resets the output Q and the counter for the remaining time to the specified value MI. The internal counter OT also is reset to 0.

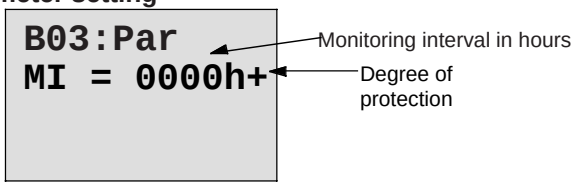
You can look at the current values for MN and OT during program execution in parameterization mode.

Limit value for OT

When you reset the hours counter with the signal R, the accumulated time remains stored in OT. The maximum limit for the counter OT is 99999 hours.

If the hours counter reaches that figure, no more hours are recorded.

Par parameter setting

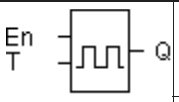


MI is the parameterizable time interval. It can be anything between 0 and 9999.

4.4.13 Symmetrical Clock Pulse Generator

Brief description

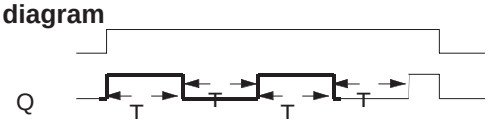
A clock pulse with a definable period length determines the output.

Symbol in IDEC SmartRelay	Connection	Description
	Input En	The En input switches the clock pulse generator on and off.
	Parameter T	T is the time for which the output is switched on or off.
	Output Q	Q switches on and off cyclically in time with the pulse period T.

Parameter T

Please refer to the note in Section 4.3.2 when specifying the values.

Timing diagram



The bold part of the timing diagram appears in the symmetrical clock pulse generator symbol.

Description of function

The parameter T specifies the length of the on and off periods. Use the En (enable) input to switch the clock pulse generator on. The pulse generator sets the output to 1 for the time T, then to 0 for the time T and so on until the En input is a 0.

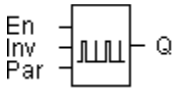
Note on the relay outputs:

Relay outputs that switch under load get worn a little with each switching operation. To find out how many switching operations a IDEC SmartRelay output can execute, refer to Chapter A on Technical Specifications.

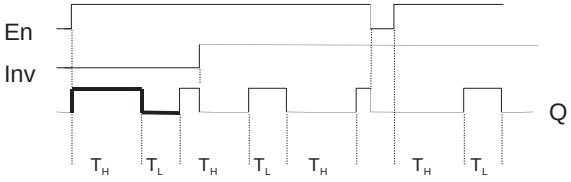
4.4.14 Asynchronous Pulse Generator

Brief description

The pulse form of the output can be modified by means of the definable pulse duration/interpulse period ratio.

Symbol in IDEC SmartRelay	Connection	Description
	Input En	The En input switches the asynchronous pulse generator on and off.
	INV input	The input INV inverts the output signal of the asynchronous clock pulse generator when active.
	Parameter Par	You can set the pulse duration T_H and the interpulse period T_L.
	Output Q	Q switches on and off cyclically with the times T_H and T_L.

Timing diagram



Description of function

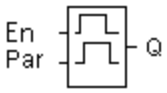
You can set the pulse duration and interpulse period using the parameters T_H (Time High) and T_L (Time Low). Both parameters have the same time base; they cannot be set individually to different bases.

The INV input allows the output to be inverted. The input INV only negates the output if the block is activated by EN.

4.4.15 Random Generator

Brief description

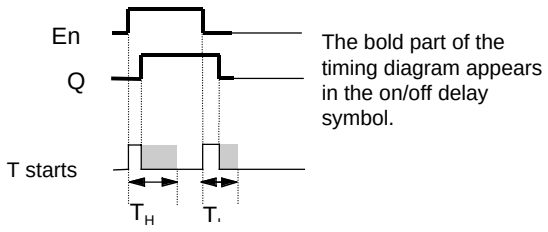
In the case of the random generator, the output is switched on and off again within a parameterizable time period.

Symbol in IDEC SmartRelay	Connection	Description
	Input En	A rising edge (change from 0 to 1) at the En (enable) input starts the on delay time of the random generator. A falling edge (change from 1 to 0) starts the off delay time of the random generator.
	Parameter Par	The on delay time is set randomly between 0 s and T_H. The off delay time is set randomly between 0 s and T_L. **T_L must have the same time base as T_H.**
	Output Q	Q switches on after the on delay time has elapsed, if Trg is still set, and switches off after the off delay time has elapsed if Trg has not been set again in the interim.

Parameters T_H and T_L

Note the default values for the parameters T_H and T_L in Section 4.3.2.

Timing diagram



Description of function

If the state at the input En changes from 0 to 1, a random time (on delay time) between 0 s and T_H is defined and started. If the state at the input En remains at 1 at least for the duration of the on delay time, the output is set to 1 after the on delay time has elapsed.

If the state at the input En switches back to 0 before the on delay time has elapsed, the timer is reset.

If the state at the input En changes again to 0, a random time (off delay time) between 0 s and T_L is defined and started.

If the state at the input En remains at 0 at least for the duration of the off delay time, the output is set to 0 after the off delay time has elapsed.

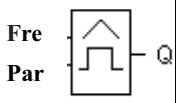
If the state at the input En switches back to 1 before the off delay time has elapsed, the timer is reset.

In the event of a power failure, the elapsed time is reset.

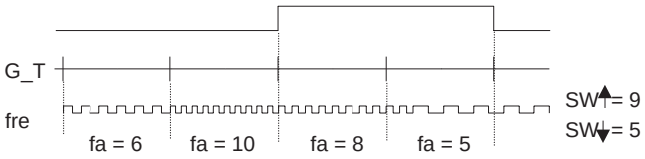
4.4.16 Frequency Trigger

Brief description

The output is switched on or off depending on whether the frequency at the input is between two definable limits.

Symbol in IDEC SmartRelay	Connection	Description
	Input Cnt	At the Cnt input apply the input that supplies the pulses to be counted. Use • Inputs I5/I6 for rapid counts (not FL1A-H10RCA, FL1A-B10RCA, FL1A-H10RCB and FL1A-B10RCB): max. 1 kHz. • Any other input or circuit component for lower frequencies.
	Parameter Par: SW ▲, SW ▼ G_T	SW ▲ on threshold SW ▼ off threshold G_T : time period over which the signal pulses applied are counted.
	Output Q	Q switches on or off depending on SW▲ and SW▼.

Timing diagram

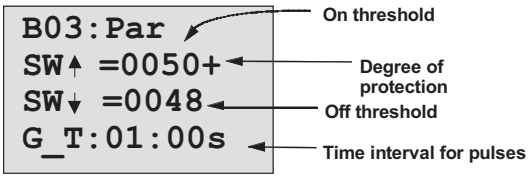


Description of function

The trigger measures the signals at the Cnt input. The pulses received are recorded over a parameterizable period G_T. If the frequency of the pulses received in the period G_T is greater than the on and the off thresholds, the output Q switches on.

Q switches off again if the measured pulse frequency reaches or falls below the off threshold.

Par parameter setting



SW↑ is the on threshold. It can be any frequency in the range 0000 to 9999.

SW↓ is the off threshold. It can be any frequency in the range 0000 to 9999.

G_T is the time interval in which the pulses applied to Cnt are measured. G_T can be a period between 00.05 s and 99.95 s.

Note

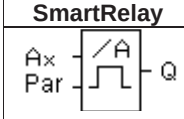
If you specify the time G_T as 1 second, IDEC SmartRelay returns the current frequency (in Hz) in the fa parameter.

fa is always the sum of the pulses measured per time unit G_T.

4.4.17 Analog Trigger

Brief description

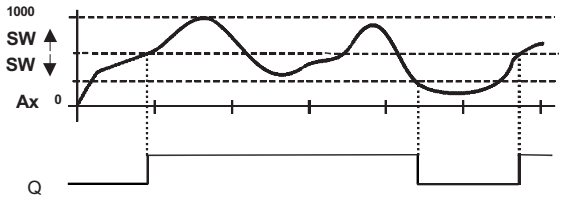
The output is switched on, if the analog value exceeds a parameterizable on threshold. The output is switched off if the analog value falls below the parameterizable off threshold (hysteresis).

Symbol in IDEC SmartRelay	Connection	Description
	Input Ax	At the output Ax, apply the analog signal to be evaluated. Use the connectors I7 (AI1) or I8 (AI2). 0-10 V corresponds to 0-1000 (internal value).
	Parameter Par: ▲▼,▲, SW ,▲ SW ▼	▲▼: Gain in % Value range 0..1000 % ▲: Offset Value range ±999 SW▲: on threshold Value range -9990 to 19990 SW▼: off threshold Value range -9990 to 19990
	Output Q	Q is set or reset depending on the threshold values.

Gain and Offset parameters

Refer to the information in Section 4.3.6 on the Gain and Offset parameters.

Timing diagram



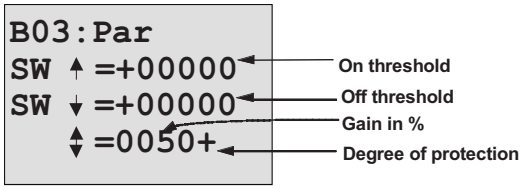
Description of function

The function reads in the analog value AI1 or AI2.
The Offset parameter is then added to the analog value.
This value is then multiplied by the Gain parameter.
If this value exceeds the on threshold (SW ↑), the output Q is set to 1.
Q is reset to 0 again if the value violates the off threshold (SW ↓).

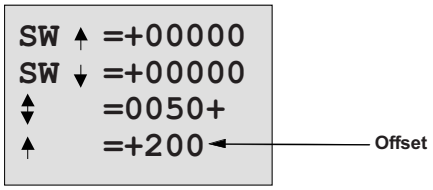
Par parameter setting

The Gain and Offset parameters are used to adapt the sensors used to the relevant application.

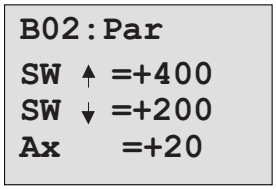
Parameter assignment



Press key ▶



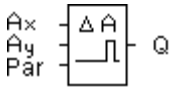
Display in PARAM mode (example):



4.4.18 Analog Comparator

Brief description

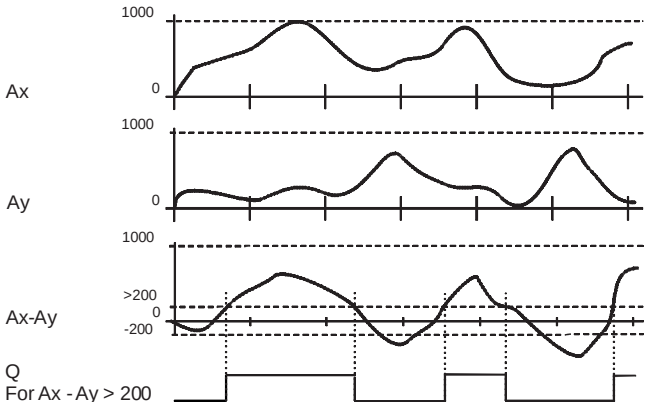
The output is switched on if the difference between Ax and Ay exceeds the set threshold value.

Symbol in IDEC SmartRelay	Connection	Description
	Inputs Ax and Ay	At the Ax and Ay inputs, apply the analog signals whose difference is to be evaluated. Use the connectors I7 (AI1) and I8 (AI2).
	Parameter Par:	: Gain in % Value range 0..1000 % : Offset Value range ±999 : Threshold value
	Output Q	Q is set to 1 if the difference between Ax and Ay exceeds the threshold value.

Gain and Offset parameters

Refer to the information in Section 4.3.6 on the Gain and Offset parameters.

Timing diagram



Description of function

The analog comparator function carries out the following arithmetic operations:

1. The value parameterized for Offset is added to Ax and Ay.
2. Ax and Ay are multiplied by the Gain parameter.
3. The function produces the difference between the analog values Ax and Ay.

If this value exceeds the threshold value parameterized under △ the output Q is set to 1.

Otherwise, Q is reset to 0.

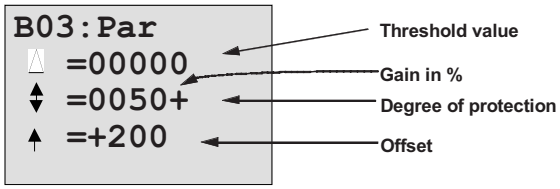
Rule for calculation

Q = 1 when:

[(Ax + offset) • gain] - [(Ay + offset) •gain] > threshold value

Par parameter setting

The Gain and Offset parameters are used to adapt the sensors used to the relevant application.

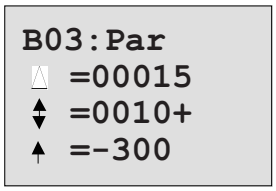


Example

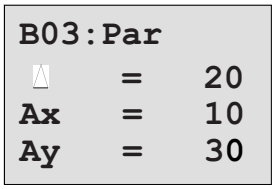
To control a heating system, the flow temperature T_v (via a sensor at AI1) and the return temperature T_r (via a sensor at AI2) are to be compared with each other.
If the return temperature differs by more than 15 °C from the flow temperature, a switching operation is to be triggered (e.g. burner on).
The real temperatures are to be displayed in PARAM mode.
Temperature sensors with the following technical specifications are available: -30 to +70 °C, 0 to 10V DC.

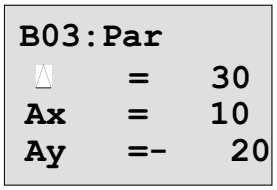
Application	Internal Representation
-30 to +70 °C = 0 to 10V DC	0 to 1000
0 °C	300 Offset = -300
Value range: -30 to +70 °C = 100	1000 Gain = 100/1000 = 0.1 = 10 %
Switching threshold = 15 °C	Threshold value = 15

Parameter assignment



Display in PARAM mode (examples):

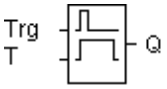




4.4.19 Stairwell Light Switch

Brief description

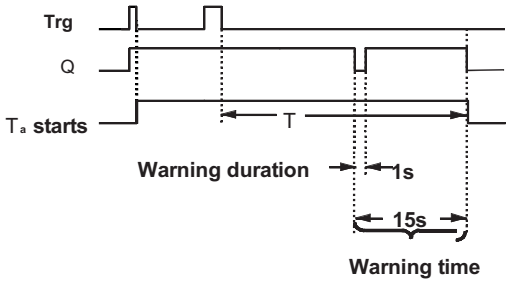
Following an input pulse (edge–controlled), a parameterizable timed period starts. The output is reset when the defined period has elapsed. 15 seconds before the time has elapsed, an off warning is issued.

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	Use the Trg (trigger) input to start the time for the stairwell light switch (off delay).
	Parameter T	T is the time after which the output is switched off (output state changes from 1 to 0). Minutes are set as the default time base.
	Output Q	Q is switched off when the time T has elapsed. 15 s before the time has elapsed, the output switches to 0 for 1 s.

Parameter T

Please refer to the note in Section 4.3.2 when specifying the values.

Timing diagram



Description of function

If the state of the input Trg changes from 1 to 0, the current time T_a starts and the output Q is set to 1.

15 s before T_a reaches the time T, the output Q is set to 0 for 1 s.

If the time T_a reaches the time T, the output Q is reset to 0.

Another switch at the input Trg during T_a resets T_a (retrigger option).

In the event of a power failure, the elapsed time is reset.

Changing the time base

You can also set other values for the warning time and warning duration .

Time Base T	Warning Time	Warning Duration
Seconds*	750 ms	50 ms
Minutes	15 s	1 s
Hours	15 min	1 min

*Only relevant for programs with a cycle time of < 25 ms

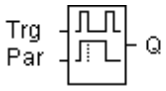
See also ”Determining the Cycle Time” in Appendix C.

4.4.20 Dual–Function Switch

Brief description

Switch with 2 different functions:

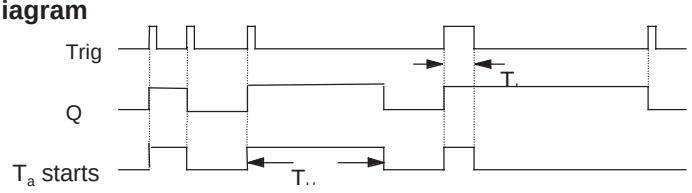
- Current impulse switch with off delay
- Switch (permanent light)

Symbol in IDEC SmartRelay	Connection	Description
	Input Trg	Switches on the output Q via the Trg (trigger) input (off delay or permanent light). When the output Q is switched on, it can be reset with Trg.
	Parameter Par	T_H is the time after which the output is switched off (output state changes from 1 to 0). T_L is the length of time that has to be set for the input to activate the permanent light function.
	Output Q	The output Q switches on with Trg and switches off again after a parameterizable time, depending on the length of the pulse to Trg, or it is reset after Trg is activated again.

Parameters T_H and T_L

Please refer to the note in Section 4.3.2 when specifying the values.

Timing diagram



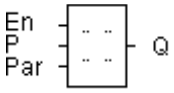
Description of function

If the state of the input Trg changes from 0 to 1, the current time T_a starts and the output Q is set to 1.
If the time T_a reaches the time T_H, the output Q is reset to 0.
In the event of a power failure, the elapsed time is reset.
If the state 0 changes to 1 at the input Trg, and 1 remains set at least for the time T_L, the permanent light function is activated and the output Q is switched on permanently.
If the input Trg is switched again, T_H is reset and the output Q is switched off.

4.4.21 Message Texts

Brief description

Display of a parameterized message text during RUN.



Symbol in IDEC SmartRelay	Connection	Description
	Input En	A change in the state from 0 to 1 at the En (Enable) input starts the output of the message text.
	Parameter P	P is the priority of the message text.
	Parameter Par	Par is the text for the message output.
	Output Q	Q has the same state as the input En.

Limitation

A maximum of 5 message text functions are possible.

Description of function

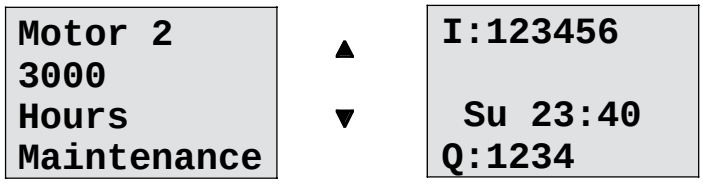
If the state at the input changes from 0 to 1, the message text you have parameterized is displayed in RUN mode.
If the state at the input changes from 1 to 0, the message text is not displayed.

If several message text functions have been triggered with En=1, the message with the highest priority is displayed.
If you press the key, ▼ the low–priority messages are displayed as well.

You can switch between the standard display and the message text display using the keys ▲ and ▼.

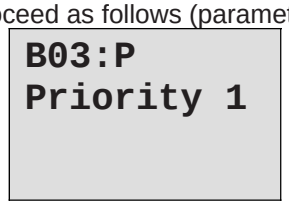
Example

A message could be displayed as follows, for example:
En=1

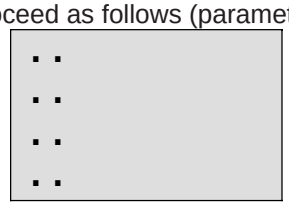


Parameter assignment window

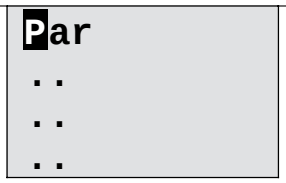
To parameterize the priority,
proceed as follows (parameter assignment window for P):



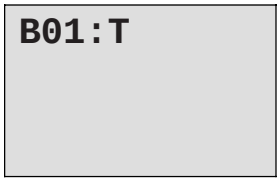
To parameterize the message text,
proceed as follows (parameter assignment window for Par):



Use the ▶ key to select a line that is to contain a message text.
Press the **OK** key to switch to edit mode for this line.
Use the ▲ and ▼ keys to select the letter to be displayed.
To move the cursor from one position to another, use the ◀ and ▶.keys.
Press **OK** to apply the changes or **ESC** to exit edit mode.
To output a parameter (e.g. display a measurement or function value) as a message text in a line, select this line with the ▶ key and press the ▼ key:



Press the **OK** key to switch to edit mode.



Use the ◄ and ► keys to select between the blocks to be displayed and the corresponding parameters.
Use the ▲ and ▼ keys to select the block or the parameter to be displayed.
To select the parameter, press **OK**.
Press the **ESC** key to exit parameter assignment mode.
Your changes are applied.

5 Parameterizing IDEC SmartRelay

Parameterization sets the parameters of the blocks. You can set the delay times for time functions, the switching times for time switches, the threshold value of a counter, the monitoring interval of an operating hours counter and the on and off thresholds of the threshold switch.

You can set the parameters:

- In programming mode
- In parameterization mode

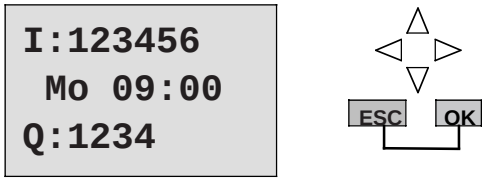
In parameterization mode the programmer sets a value for a parameter.

We introduced parameterization mode so parameters can be changed without having to change the program. A user can change the times without having to change into programming mode. The advantage of this is that the program (and thus the circuit) is protected but can still be modified by the user to suit requirements.

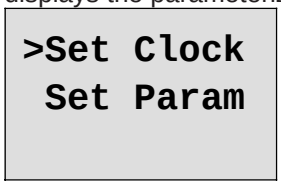
Note
IDEC SmartRelay continues to execute the program in parameterization mode.

5.1 Switching to Parameterization Mode

To switch to parameterization mode, press ESC and OK at the same time:



IDEC SmartRelay switches to parameterization mode and displays the parameterization menu:



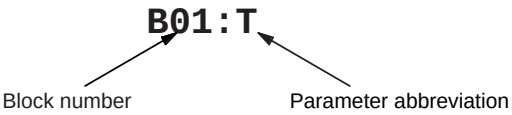
The ‘Set Clock’ menu item is executed only if your version of IDEC SmartRelay has a clock/time switch (those versions of IDEC SmartRelay that have a clock have the letter C in their name e. g. FL1A-H10RCB). Set Clock allows you to set IDEC SmartRelay’s time switch.

5.1.1 Parameters

The following can be parameters:

- The delay times of a time relay.
- The switching times (cams) of a time switch.
- The threshold value of a counter.
- The monitoring time of an operating hours counter.
- The switching thresholds of a threshold switch.

The block number and the parameter abbreviation identify each parameter. Examples:

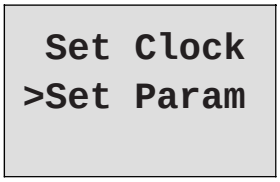


- T: ...is a time that can be set.
- No1: ...is the first cam of a time switch (clock).
- Par: ...refers to several counters that can be monitored.

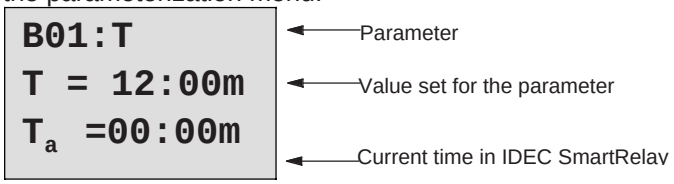
5.1.2 Selecting a Parameter

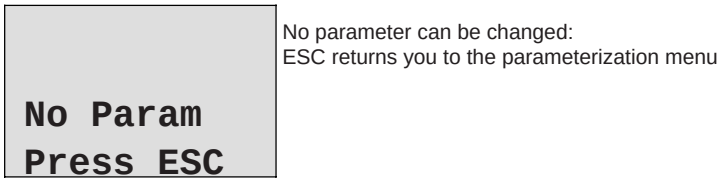
To select a parameter, proceed as follows:

1. Select the ‘Set Param’ option from the parameterization menu.



2. Press the OK key
   IDEC SmartRelay displays the first parameter. If parameters cannot be set, you can use ESC to return to the parameterization menu.





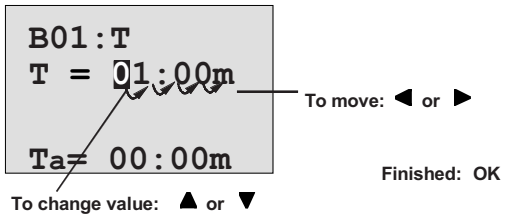
3. Select the desired parameter:
   ▲ or ▼
   The parameter displays in a separate window.
4. To change a parameter, select it and press OK.

5.1.3 Changing a Parameter

To change a parameter, you first have to select it (see “Selecting a parameter”).

Change the value of the parameter in the same way you entered it in programming mode:

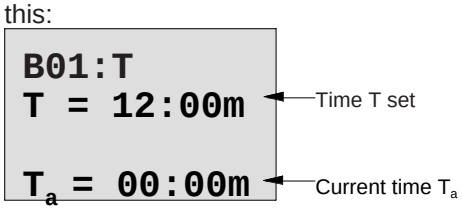
1. Move the cursor to the point at which you want to make the change:
   ◄ or ►
2. Change the value:
   ▲ or ▼
3. Accept the value:
   OK



You cannot change the unit of the delay time for the parameter T in parameterization mode. This is only possible in programming mode.

Current value of a time T

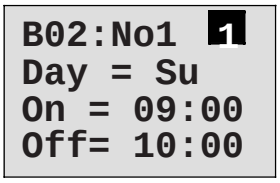
If you view a time T in parameterization mode, it looks like this:



You can change the set time T (see “Changing a parameter”).

Current value of the time switch

If you view a cam of a time switch in parameterization mode, it looks like this:



The circuit state of the time switch is displayed:

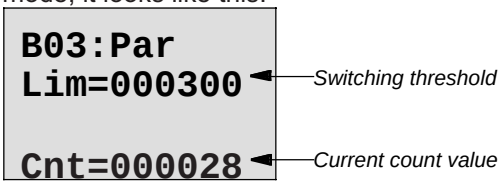
0 *The time switch is off (state '0' at the output)*

1 *The time switch is on (state '1' at the output)*

IDEC SmartRelay displays the circuit state of the time switch rather than the circuit state of a cam. The circuit state of the time switch depends on all three cams (No1, No 2 and No 3).

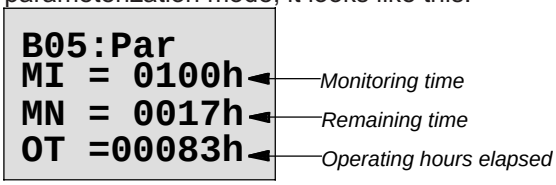
Current value of a counter

If you view the parameter of a counter in parameterization mode, it looks like this:



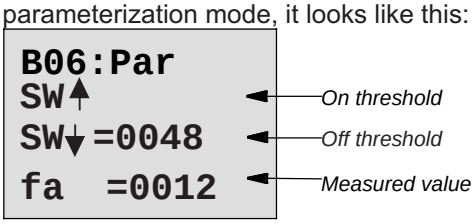
Current value of an operating hours counter

If you view the parameters of an operating hours counter in parameterization mode, it looks like this:



Current value of a threshold switch

If you view the parameter of a threshold switch in parameterization mode, it looks like this:



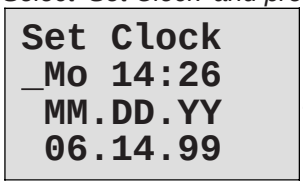
5.2 Setting the Time (FL1A- ... C…)

You can set the time:

- *In parameterization mode*
- *In programming mode*

Setting the time in parameterization mode:

1. *Switch to parameterization mode:*
   ESC and OK at the same time
2. *Select 'Set Clock' and press OK.*



The cursor is positioned before the day of the week.

3. *Select the day of the week:*
   ▲ *or* ▼
4. *Move the cursor to the next position:*
   ◀ *or* ▶
5. *Change the value:*
   ▲ *or* ▼
6. *Set the clock to the correct time. Repeat steps 4 and 5.*
7. *Conclude your input:*
   OK

Setting the time in programming mode:

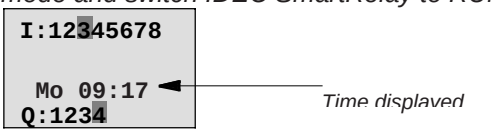
1. *Switch to programming mode:*
   ◀, ▶ *and OK at the same time*
2. *Select 'Program' and press OK*
3. *Select (using* ▼ *or* ▲*) 'Set Clock' and press OK*

Now you can set the day of the week and the time, as described above (as of step 3.).

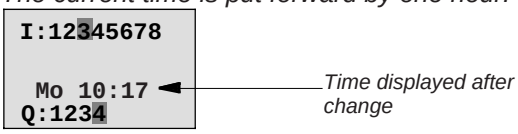
Switching between summer and winter time:

IDEC SmartRelay must be in RUN if you want to switch over the time.

1. *If necessary, exit programming or parameterization mode and switch IDEC SmartRelay to RUN.*

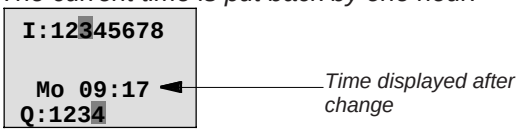


2. *Press OK and ▲*
   The current time is put forward by one hour.



Change the time in the opposite direction in the same way:

3. *Press OK and ▼*
   The current time is put back by one hour.



6 IDEC SmartRelay Memory Cartridge

You can keep only one program stored in IDEC SmartRelay. If you want to change the program or write another program without deleting the first one, you must archive it somewhere. You must archive it to a memory cartridge.

You can copy the program stored in IDEC SmartRelay to a memory cartridge. You can insert the memory cartridge in a different IDEC SmartRelay and copy the program to the other IDEC SmartRelay. You can use the memory cartridge to do the following:

- Archive programs
- Duplicate programs
- Send programs by ground mail
- Write and test programs in the office and then transfer them to a different IDEC SmartRelay in the cabinet.

IDEC SmartRelay is supplied with a cover. You must order the memory cartridge separately.

Note
You do not require a memory cartridge for permanently storing the program in your IDEC SmartRelay. **The IDEC SmartRelay program is already stored permanently when programming mode is finished.**

Below you will find the two memory cartridges available for IDEC SmartRelay. Both can accommodate the entire program memory of a IDEC SmartRelay.

Memory Cartridge	Type No.
Memory cartridge (Yellow) : for copying	FL1A-PM1
Memory cartridge (Red) : with know–how protection and copy protection	FL1A-PM2

Memory Cartridge (Yellow)

You can read and write programs with this memory cartridge.

Memory Cartridge (Red)

You can only write programs with this memory cartridge. Once a program has been stored, it cannot be looked at, copied or changed (i.e. your data is protected).
Programs saved like this can only be run if the module remains inserted in IDEC SmartRelay while the system is in operation.

Warning

Do not save your program on a memory cartridge with program protection if you intend to edit it further.

You can start up a program on a memory cartridge with know-how protection but not read it for the purpose of editing.

6.2 Removing and Inserting Program Memory Cartridge

When you remove a red memory cartridge (know–how protection and copy protection), always remember that the program stored on the memory cartridge can only run if the memory cartridge is inserted and remains inserted for the entire time.
If the memory cartridge is removed, IDEC SmartRelay displays the message ’no program’. Removing the red memory cartridge during operation leads to impermissible operating statuses.
Always heed the following warning:

Warning

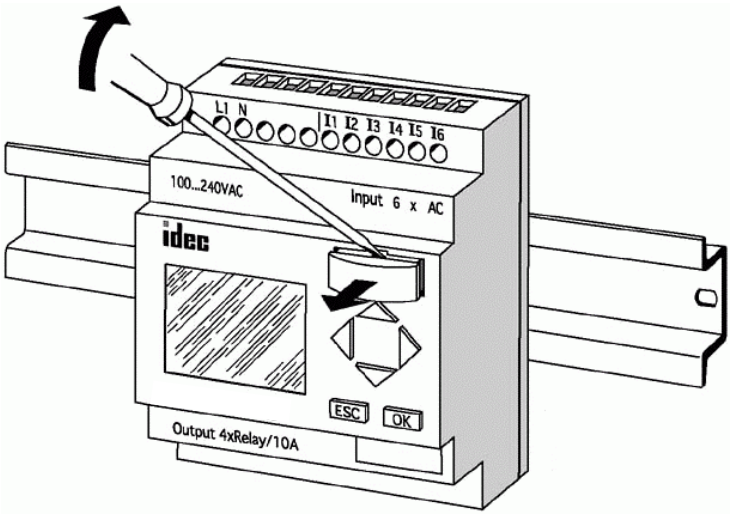
Do not put your finger or an object made of metal or any other conductive material in the open shaft of the memory cartridge.

The socket for the memory cartridge may be live if L1 and N have been incorrectly wired.

Only a trained technician should change the memory cartridge.

Removing the memory cartridge

Remove the memory cartridge as follows:



Carefully insert a screwdriver into the slot at the upper end of the memory cartridge and ease the memory cartridge out of the shaft a little.

You can now remove the memory cartridge.

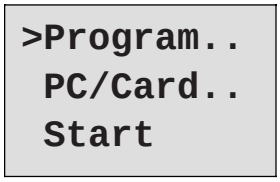
Inserting the memory cartridge

The shaft for the memory cartridge is chamfered at the lower right edge. The memory cartridge also has a chamfered edge. This prevents you from inserting the memory cartridge the wrong way around. Insert the memory cartridge into the shaft until it engages.

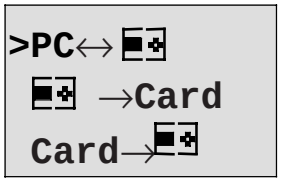
6.3 Copying a Program from IDEC SmartRelay to the Memory Cartridge

To copy a program to the memory cartridge, proceed as follows:

1. Insert the memory cartridge into the shaft.
2. Switch IDEC SmartRelay to programming mode:
   ◀, ▶ and OK at the same time



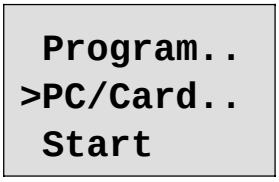
3. Move the '>' to "PC/Card":
4. Press OK. The transfer menu appears.



= IDEC SmartRelay

5. Move the '>' to 'IDEC SmartRelay -> Card':
6. Press OK.

IDEC SmartRelay copies the program to the memory cartridge.
When IDEC SmartRelay has finished copying, it automatically returns to the main menu:



The program is now also on the memory cartridge. You can now remove the memory cartridge: Don't forget to replace the cover.

If there is a power failure while IDEC SmartRelay is copying, you have to copy the program again once the power has been restored.

6.4 Copying from the Memory cartridge to IDEC SmartRelay

If you have a memory cartridge containing your program, you can copy the program to IDEC SmartRelay in two ways:

- Automatically when IDEC SmartRelay starts up (power on)
- Via IDEC SmartRelay's PC/Card menu.

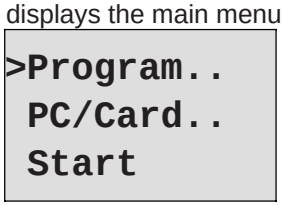
Note
Please note that not all programs stored on the memory cartridges can be read in all IDEC SmartRelay variants. If necessary, read Section 6.1 again.

Automatic copying when IDEC SmartRelay starts up

Proceed as follows:

1. Switch off the power supply to IDEC SmartRelay (power down)
2. Remove the cover shaft.
3. Insert the memory cartridge into the appropriate shaft.
4. Switch on the power supply to IDEC SmartRelay again.

Result: IDEC SmartRelay copies the program from the memory cartridge to IDEC SmartRelay. As soon as IDEC SmartRelay has finished copying, IDEC SmartRelay displays the main menu:



Note

Before you switch IDEC SmartRelay to RUN, you must ensure that the system you are controlling with IDEC SmartRelay does not represent a source of danger.

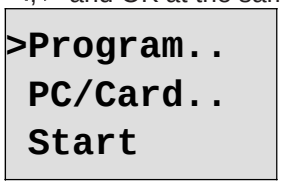
1. Move the '>' to Start:
   2 x key ▼
2. Press OK

Using the PC/Card menu to copy

Read the note about changing the memory cartridge.

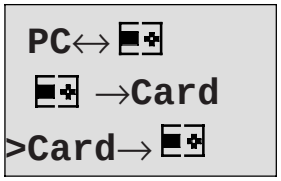
To copy a program from the memory cartridge to IDEC SmartRelay, proceed as follows:

1. Insert the memory cartridge
2. Switch IDEC SmartRelay to programming mode:
   ◄, ► and OK at the same time



3. Move the '>' to "PC/Card":
   ▼

4. Press OK. The transfer menu appears.



5. Move the '>' to 'Card -> IDEC SmartRelay:
   key ▲ or ▼
6. Press OK.

Result: IDEC SmartRelay copies the program from the memory cartridge to IDEC SmartRelay As soon as IDEC SmartRelay has finished copying, IDEC SmartRelay automatically displays the main menu.

7 IDEC SmartRelay Software

The program WindLGC is available as a programming package for the PC. The software has the following functions:

- Offline program generation of your application
- Simulation of your circuit (or program) on the computer
- Generation and printing of a block diagram of the circuit
- Saving the program to the hard disk or another storage medium
- Program transfer
  - From IDEC SmartRelay to the PC
  - From the PC to IDEC SmartRelay

The IDEC SmartRelay alternative

The IDEC SmartRelay programming software represents an alternative to the conventional means of planning:

1. Develop your applications at your desk.
2. Simulate the application in your computer and test whether or not it functions properly before the circuit is actually put to use.
3. Print out the entire circuit in a block diagram or in several block diagrams sorted according to outputs.
4. Archive your circuits in your PC file system. In this way you can retrieve a circuit directly if you want to make changes some time in the future.
5. Transfer the program to IDEC SmartRelay by pressing just a few buttons. Your IDEC SmartRelay is retooled within a very short space of time.

7.1 Possible Applications for IDEC SmartRelay Software

System requirements

The following requirements have to be met in order to run WindLGC:

- IBM–compatible PC
- Pentium 90 or higher
  (Pentium 133 recommended)
- 32 MB RAM
  (64 MB RAM recommended)
- 90 MB of free hard disk space
- Microsoft Windows 95/98 or NT4.0
- SVGA graphics card, resolution 800x600, 256 colors
  (1024x768 recommended)
- CD–ROM drive + mouse

Installation and operation

Before installation, read the product information documentation and the text files on the CD–ROM.

To install the software, simply follow the instructions on the installation program. To start the installation program, proceed as follows (installation on CD–ROM should start automatically):

1. Select and start SETUP.EXE
   in Windows 95/98 and Windows NT 4.0 either by choosing Start/Run and entering the line: [drive]:\Setup or by clicking it in Windows Explorer.
2. Follow the instructions in the installation program.

If you have any questions, use the online software help system.

The next steps

In the next step we will show you how to connect IDEC SmartRelay to a PC. Omit this step if you currently have only the software available.

7.2 Connecting IDEC SmartRelay to a PC

Connecting a PC Cable

To connect IDEC SmartRelay to a PC, you need the IDEC SmartRelay PC Cable.
(Type No. FL1A-PC1).

Remove the cover or the Memory Cartridge on your IDEC SmartRelay and connect the cable there. Connect the other end of the cable to the serial port of your PC.

Switching IDEC SmartRelay to PC -> IDEC SmartRelay Mode

There are two ways to connect the PC and IDEC SmartRelay. IDEC SmartRelay is either switched to transfer mode when it is on or automatically when the IDEC SmartRelay power supply is switched on and the transfer cable is in place.

To switch IDEC SmartRelay to PC <-> IDEC SmartRelay mode, proceed as follows:

1. Switch IDEC SmartRelay to programming mode:
   Press ◀, ▶ and OK at the same time
2. Select 'PC/Card':
   ▼ or ▲
3. Press OK
4. Select 'PC <-> IDEC SmartRelay':
   ▼ or ▲
5. Press OK

IDEC SmartRelay is now in PC <-> IDEC SmartRelay mode and the following display appears:

To switch IDEC SmartRelay automatically to PC <-> IDEC SmartRelay mode, proceed as follows:

1. Switch off the power supply to IDEC SmartRelay.
2. Remove the cover or the Memory Cartridge and connect the cable there.
3. Switch the power back on.

IDEC SmartRelay automatically goes into PC <-> IDEC SmartRelay mode.

The PC can now access IDEC SmartRelay. Find out how to do this on the online help system of the IDEC SmartRelay software.

You can interrupt the connection to the PC using ESC on IDEC SmartRelay.

7.3 Transfer Settings

To transfer programs between the PC and IDEC SmartRelay, you must make certain settings in the IDEC SmartRelay software. You can make these settings using the menu of the software you are using.

WindLGC

- **Specify which IDEC SmartRelay**: WindLGC works out which IDEC SmartRelay variant you will need to use the written program.
- **Options -> Interface**: You can enter the serial port to which IDEC SmartRelay is connected. You can also find out the correct port automatically (the program checks each port for a connected IDEC SmartRelay).
- **Transfer: PC -> IDEC SmartRelay**: Use this to transfer a program you have created in WindLGC to IDEC SmartRelay.
- **Transfer: IDEC SmartRelay -> PC**: Use this to transfer a program you have created in IDEC SmartRelay to WindLGC.

8 Applications

To give you an idea of the kind of situations in which you can use IDEC SmartRelay, we have compiled a number of application examples. We have included the circuit diagram of the original solution for each example and compared it with the solutions using IDEC SmartRelay.

You can find solutions for the following tasks:

8.1 Stairway or hall lighting 8-2
8.2 Automatic door 8-7
8.3 Ventilation system 8-14
8.4 Industrial gate 8-19
8.5 Fluorescent lights 8-23
8.6 Water pump 8-27
8.7 Further applications 8-31

Note

The IDEC SmartRelay applications are provided free of charge to our customers. The examples they contain are not binding and are included to provide general information on how IDEC SmartRelay can be used. Customer-specific solutions may be different.

The user is responsible for ensuring that the system operates properly. It must comply with any and all applicable local standards and system-related installation regulations.

Errors are excepted and the right to make changes reserved.

8.1 Stairwell or Hall Lighting

8.1.1 Demands on Stairwell Lighting

The basic requirements for a stairwell lighting system in an apartment block are as follows:

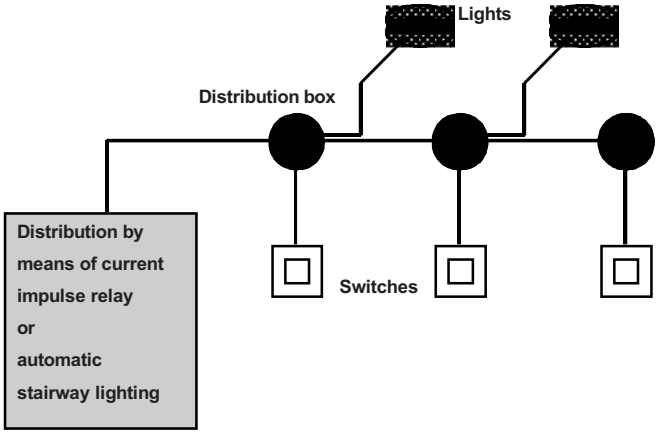
- When someone is using the stairs, the stairwell lights should be on.
- If no one is in the stairwell, the lights should go out in order to save energy.

8.1.2 Previous Solution

Conventionally, there have been two ways to control such a lighting system as follows:

- By means of a current impulse relay
- By means of automatic stairway lighting

The wiring for the two lighting systems is identical.



Components used

- Switches
- Automatic lighting device or current impulse relay

Lighting system with a current impulse relay

When a current impulse relay is used, the lighting system behaves as follows:

- When any switch is pressed: the lighting is switched on
- When any switch is pressed again: the lighting is switched off

Disadvantage: people frequently forget to switch the lights off.

Lighting system with an automatic lighting device

When an automatic device is used, the lighting system behaves as follows:

- When any switch is pressed: the lighting is switched on
- When the preset time has elapsed, the lights switch off automatically.

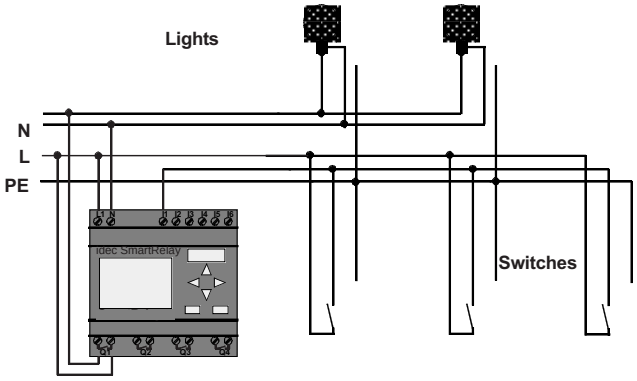
Disadvantage: The lighting cannot be switched on for an extended period of time (e.g. for cleaning purposes). The permanent on switch is usually on the stairwell lighting timer unit which may be difficult or impossible to access.

8.1.3 Lighting System with IDEC SmartRelay

You can use a IDEC SmartRelay module to replace the stairwell lighting timer or the current impulse relay. And you can implement both functions (timed off delay and current impulse relay) in a single unit. What is more, you can incorporate extra functions without making any alterations to the wiring. Here are some examples:

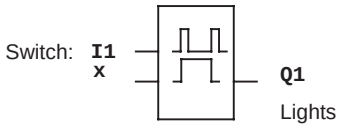
- Current impulse relay with IDEC SmartRelay
- Automatic stairway lighting system with IDEC SmartRelay
- IDEC SmartRelay as a multifunctional switching system with the following functions:
  - Light on: Press switch
    (Light switches off after the set time elapses)
  - Permanent light on: Press switch twice
  - Light off: Press switch for 2 seconds

Wiring of the lighting system with FL1A-H10RCB



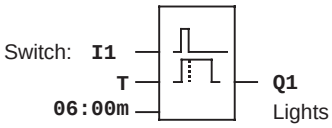
The external wiring for the lighting system using a IDEC SmartRelay module is no different from the conventional method of wiring a corridor or stairwell lighting system. Only the automatic lighting timer/current impulse relay is replaced. Additional functions are entered directly in IDEC SmartRelay.

Current impulse relay with IDEC SmartRelay



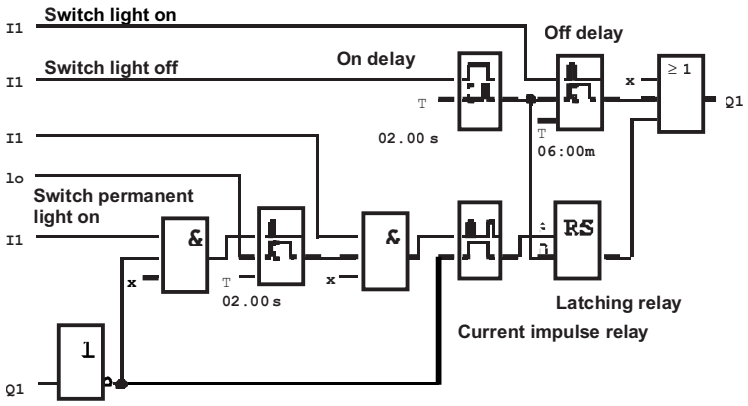
In the event of a gate pulse at input I1, output Q1 switches over.

Automatic stairway lighting system with IDEC SmartRelay



In the event of a gate pulse at input I1, output Q1 switches on and remains on for 6 minutes.

Multifunctional switch with IDEC SmartRelay



The diagram shows the circuit for an input with an associated output.

This switch has the following options:

- **When the switch is pressed:** The light is switched on and goes off again after the set time of 6 minutes (T=06:00m) has elapsed (off delay)
- **When the switch is pressed twice:** The light is switched on permanently (the latching relay is set via the current impulse relay).
- **When the switch is pressed for 2 seconds:** The light is switched off (on delay switches off both the permanent light and the normal light; this branch of the circuit is used twice).

You can enter these circuits several times for the remaining inputs and outputs. Instead of using 4 automatic stairway lighting systems or 4 current impulse relays, you thus use only a single IDEC SmartRelay. You could also use the free inputs and outputs for completely different functions.

8.1.4 Special Features and Enhancement Options

Features such as the following are available for adding functions or saving energy:

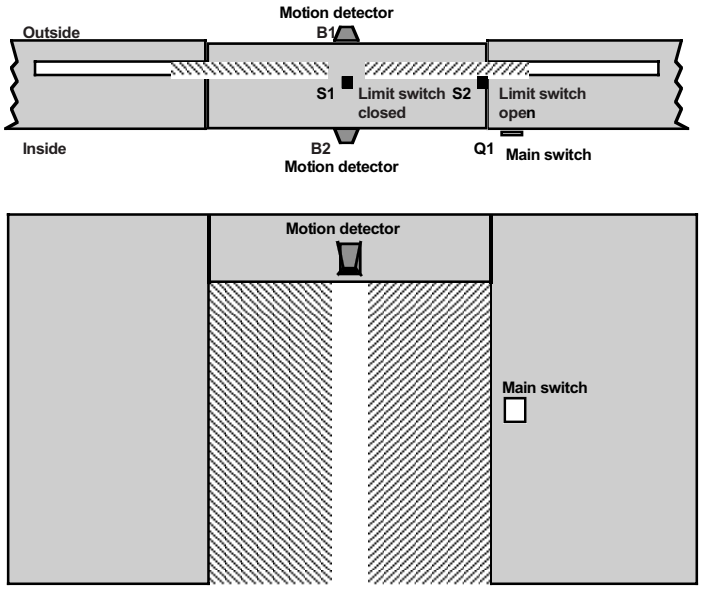
- You can have the light flash before it goes off automatically.
- You can integrate various central functions:
  - Central off
  - Central on (panic button)
  - Control of all lights or individual circuits by a daylight control switch
  - Control by the integrated time switch (e.g. permanent light only until 24.00 hours; no enabling at certain times)
  - Automatic switching off of the permanent light after a preset time has elapsed (e.g. after 3 hours)

8.2 Automatic Door

You often find automatic door control systems at the entrance to supermarkets, public buildings, banks, hospitals, etc.

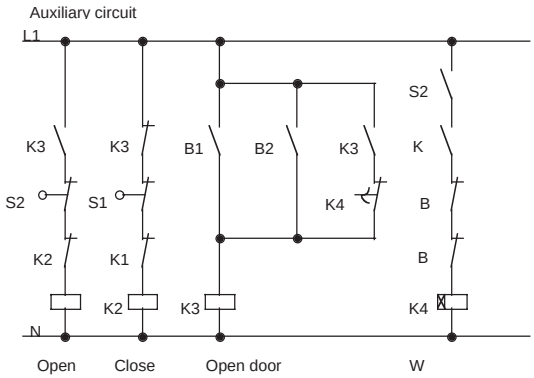
8.2.1 Demands on an Automatic Door

- When somebody approaches, the door must open automatically.
- The door must remain open until there is nobody in the doorway anymore.
- If there is nobody in the doorway, it must close automatically after a short time.



A motor with a safety clutch generally drives the door. This prevents people from being caught or injured in the door. The control system is connected to the mains via a main switch.

8.2.2 Previous Solution

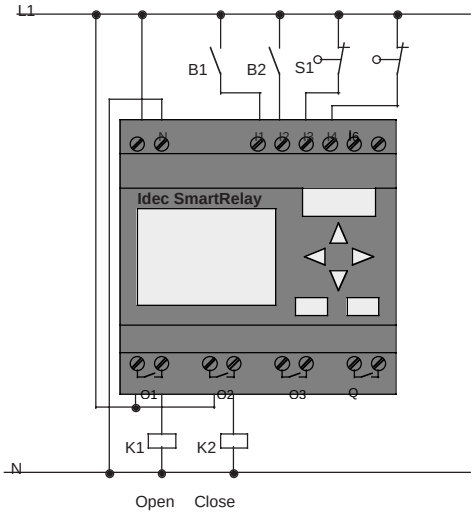


As soon as one of the motion detectors B1 or B2 registers somebody's presence, the door is opened by K3.
If the two motion detectors detect nothing for a minimum period, K4 enables the close operation.

8.2.3 Door Control System with IDEC SmartRelay

IDEC SmartRelay allows you to considerably simplify the circuit. You need only connect the motion detectors, the limit switches and the master contactors to IDEC SmartRelay.

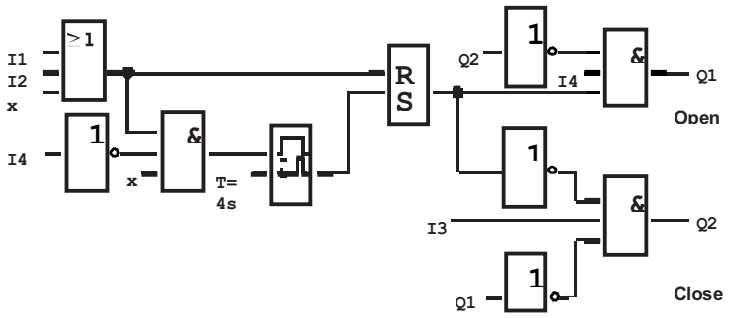
Wiring of the door control system with FL1A-H10RCB



Components used

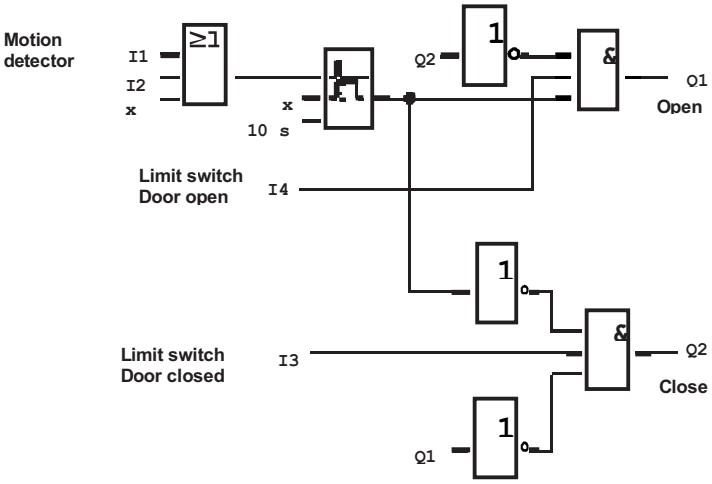
- K1 Master contactor *Open*
- K2 Master contactor *Close*
- S1 *(NC contact)* Limit switch *Closed*
- S2 *(NC contact)* Limit switch *Open*
- B1 *(NO contact)* Infrared motion detector *Outside*
- B2 *(NO contact)* Infrared motion detector *Inside*

Diagram of the door control system with IDEC SmartRelay



This is the functional block diagram that corresponds to the circuit diagram of the conventional solution.

You can simplify this circuit using IDEC SmartRelay's functions. Use the off delay to replace the latching relay and on delay. The following function block diagram illustrates this simplification:



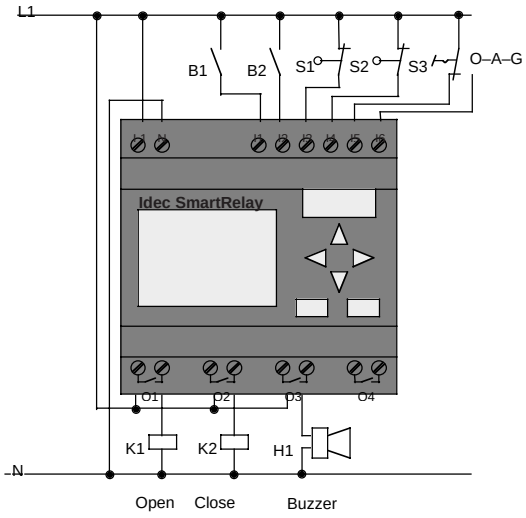
8.2.4 Special Features and Enhancement Options

Functionality and user friendliness can be improved in the following ways:

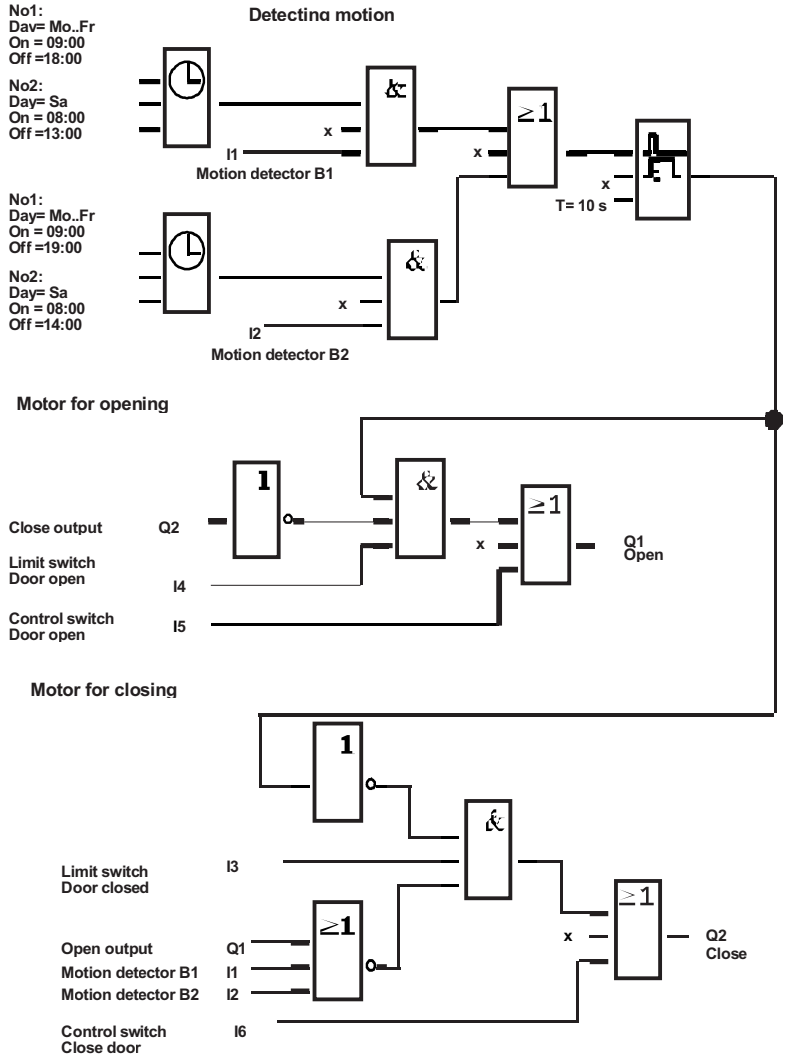
- You can connect an additional control switch: Open - Automatic - Closed (O–A–C)
- You can connect a buzzer to one of IDEC SmartRelay's outputs to indicate when the door is about to close.
- You can include time and direction–dependent enabling of door opening (so that it only opens operating hours or only from the inside to the outside after closing time).

8.2.5 Enhanced FL1A-H10RCB Solution

Wiring of the enhanced IDEC SmartRelay solution



Functional block diagram of the enhanced IDEC SmartRelay solution



Detecting motion

During business hours, motion detector B1 opens the door as soon as somebody wants to enter the shop from outside. Motion detector B2 opens the door if somebody wants to leave the shop.

After closing time, motion detector B2 continues to open the door for 1 hour so customers can leave the shop.

Motor for opening

Output Q1 is switched on and opens the door when the following occurs:

- The control switch at 15 is operated (the door is to be constantly open) or
- The motion detectors indicate that somebody is approaching the door and
- The door is not yet fully open (limit switch at I4).

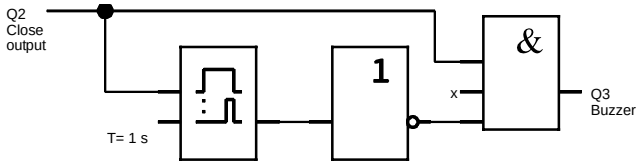
Motor for closing

Output Q2 is switched on and closes the door when the following occurs:

- The control switch at 16 is operated (the door is to be constantly closed) or
- The motion detectors indicate that there is nobody near the door and
- The door is not yet fully closed (limit switch at I3).

Buzzer

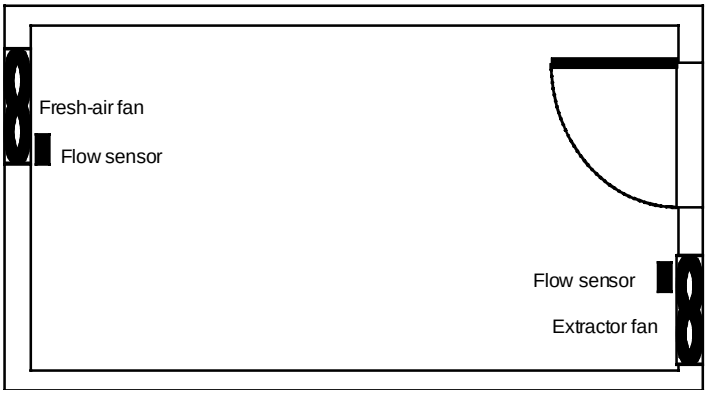
Connect the buzzer to output Q3. The buzzer sounds for a short time (in this case 1 second) when the door is closed. Enter the following circuit at Q3 in the block diagram:



8.3 Ventilation System

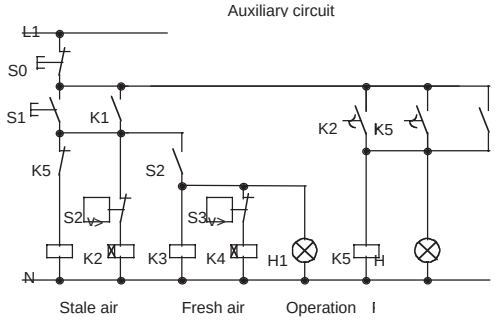
8.3.1 Demands on a Ventilation System

The purpose of a ventilation system is either to bring fresh air into a room or to extract stale air from a room. Consider the following example:



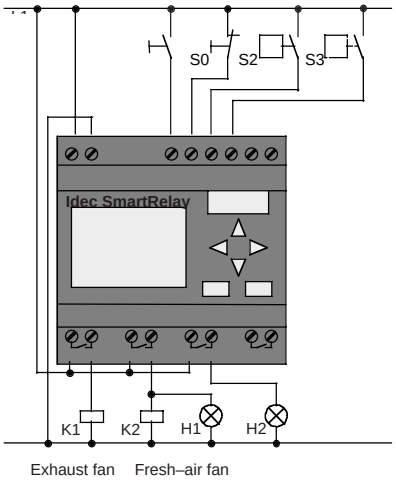
- The room contains an extractor fan and a fresh–air fan.
- Both fans are monitored by a flow sensor.
- The pressure in the room must not be allowed to rise above atmospheric pressure.
- The fresh-air fan must only switch on when the extractor fan is triggered by the flow sensor.
- A warning lamp indicates if one of the fans fails.

The circuit diagram for the previous solution is as follows:



Flow sensors monitor the fans. If, after a short delay, no airflow is registered, the system is switched off and a fault reported. Acknowledge this by pressing the stop switch. Monitoring the fans requires an analyzer circuit with several switching devices in addition to the flow sensors. A single IDEC SmartRelay module can replace the analyzer circuit.

Wiring of the ventilation system with FL1A-H10RCB

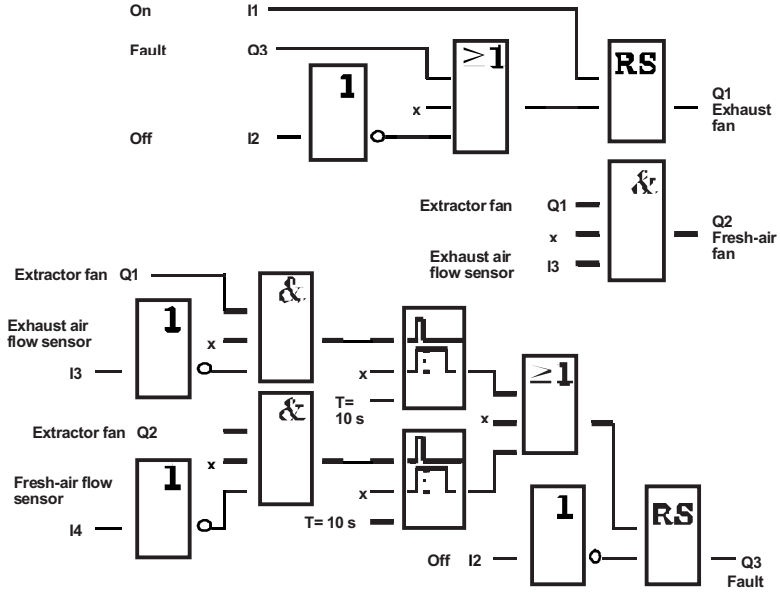


Components used

- K1 Master contactor
- K2 Master contactor
- S0 *(NC contact)* Stop switch
- S1 *(NO contact)* Start switch
- S2 *(NO contact)* Flow sensor
- S3 *(NO contact)* Flow sensor
- H1 Indicator lamp
- H2 Indicator lamp

Block diagram of the IDEC SmartRelay solution

The block diagram of the ventilation control system with IDEC SmartRelay is as follows:



8.3.2 Advantages of Using IDEC SmartRelay

Using a IDEC SmartRelay module requires fewer switching devices. That saves installation time and space in the control cabinet. Under certain circumstances it may even allow you to use a smaller control cabinet.

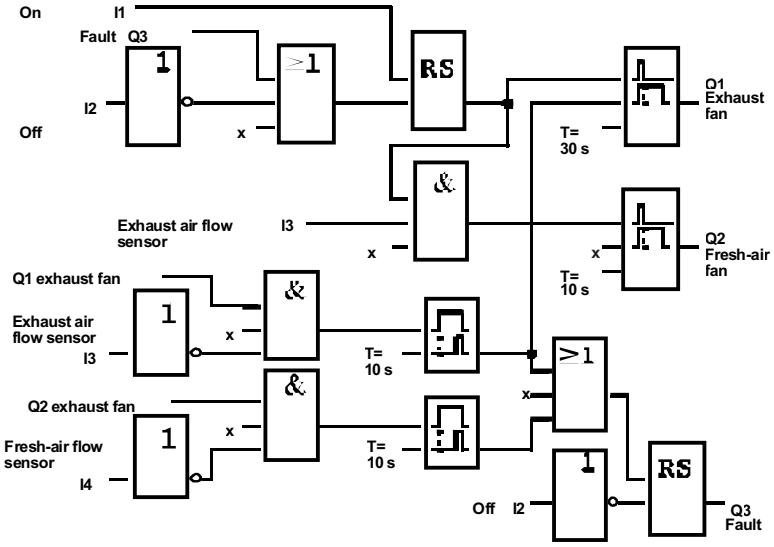
Additional options when using IDEC SmartRelay

- The free output (Q4) can be used as a potential–free signaling contact in the event of a fault or a power failure.
- It is possible to stagger the switching–off of the fans.

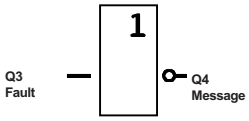
These functions can be implemented without additional switching devices.

Functional block diagram of the enhanced IDEC SmartRelay solution

The fans at Q1 and Q2 are switched on and off as shown in the following circuit:

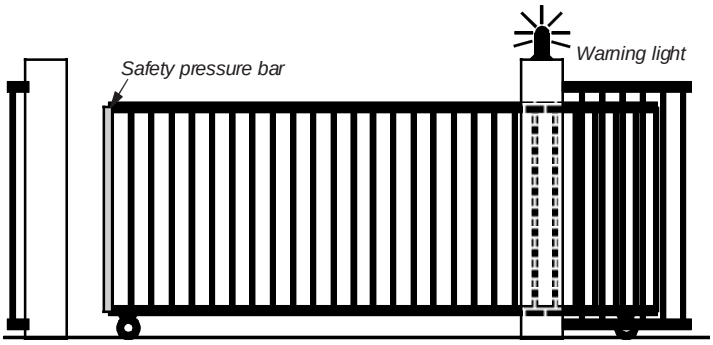


You can also generate a message via output Q4:



The relay contacts of output Q4 are always closed when the system is running. Relay Q4 does not release unless there is a power failure or a fault in the system. This contact can be used for teleindication, for example.

8.4 Industrial Gate



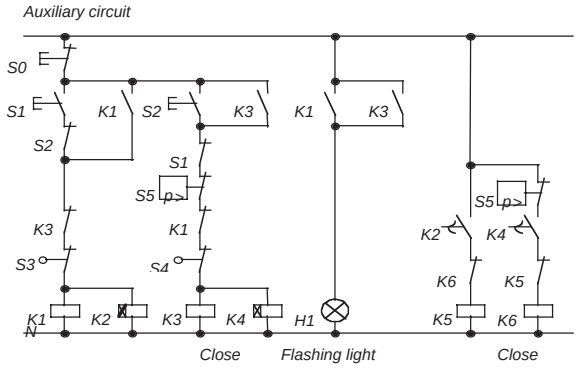
There is often a gate at the entrance to private properties. This is opened only to let vehicles in and out.
The gate is controlled by the gateman.

8.4.1 Demands on the Gate Control System

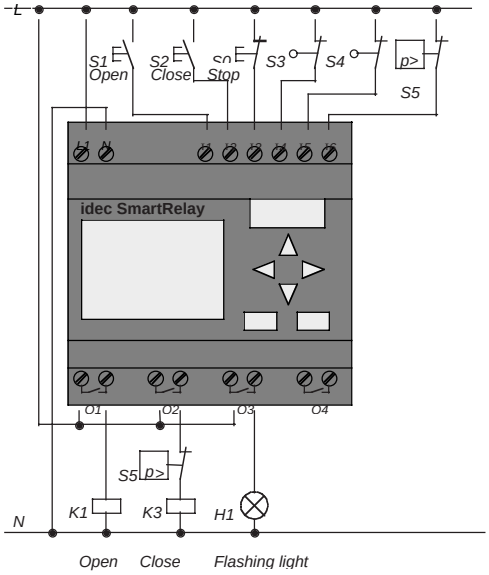
- The gate is opened and closed by operating a switch in the gatehouse. The gateman is able to monitor the operation of the gate at the same time.
- The gate is normally fully opened or closed. However, movement of the gate can be halted at any time.
- A flashing light is activated 5 seconds before the gate begins to move and continues for as long as the gate is in motion.
- A safety pressure bar ensures that nobody gets injured and nothing gets trapped or damaged when the gate closes.

8.4.2 Previous Solution

Various kinds of control systems are used to operate automatic gates. The circuit diagram shows *one* possible gate control circuit.



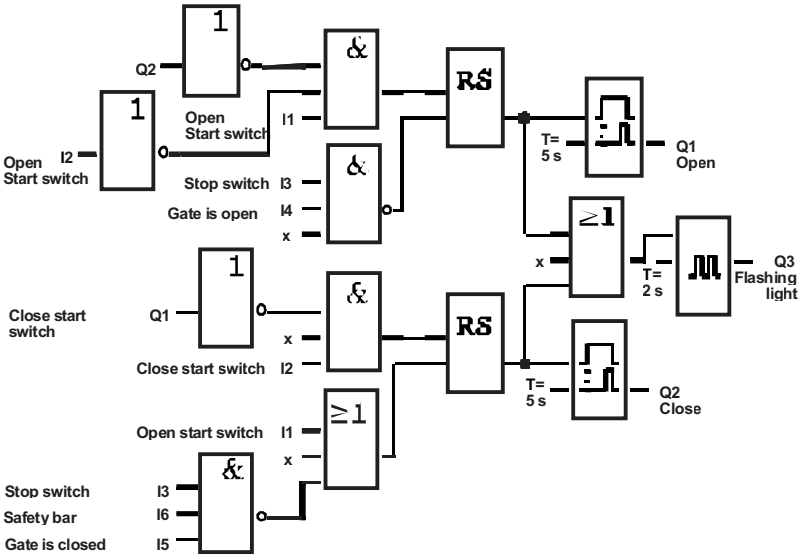
Wiring of the gate control system with FL1A-H10RCB



Components used

- K1 Master contactor
- K2 Master contactor
- S0 *(NC contact)* Stop switch
- S1 *(NO contact)* Open switch
- S2 *(NO contact)* Close switch
- S3 *(NC contact)* Open position switch
- S4 *(NC contact)* Closed position switch
- S5 *(NC contact)* Safety pressure bar

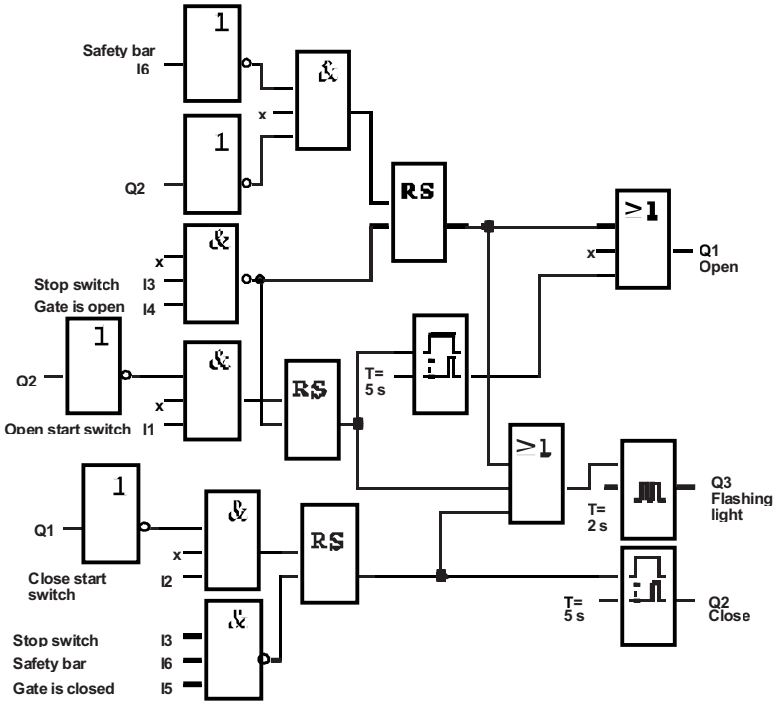
Functional diagram of the IDEC SmartRelay solution



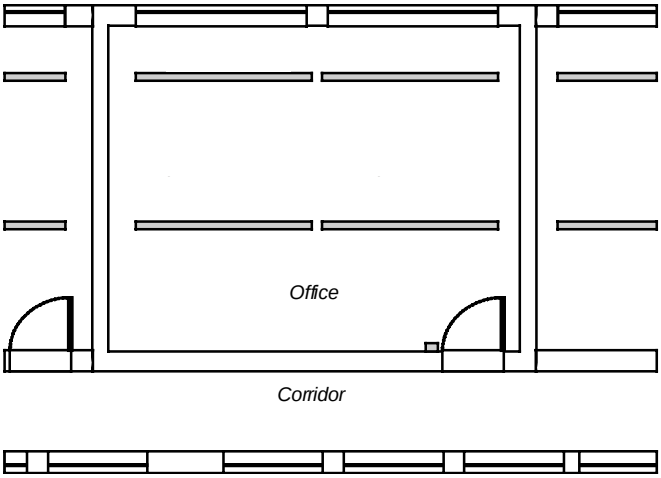
The open and close start switches move the gate in the appropriate direction, provided it is not already moving in the other direction. The stop switch or the relevant limit switch halts movement of the gate. The gate is also prevented from closing by the safety bar.

8.4.3 Enhanced IDEC SmartRelay Solution

In our enhanced solution the gate will automatically open again when the safety bar is operated.



8.5 Fluorescent Lights

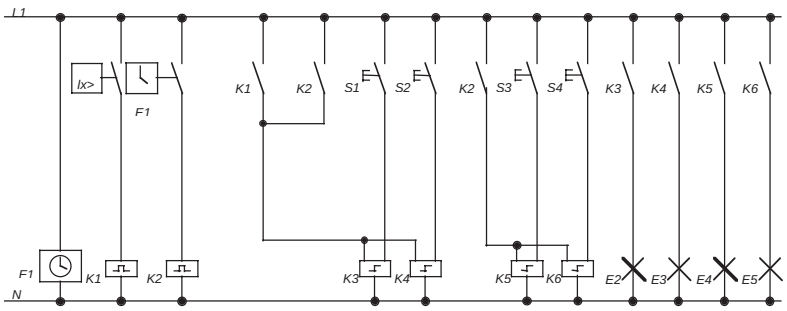


When planning lighting systems, the type and number of lamps used depends on the level of lighting required. For reasons of cost efficiency, fluorescent lights arranged in rows of tubes are often used. They are subdivided into switching groups according to how the room is used.

8.5.1 Demands on the Lighting System

- The fluorescent lights are switched on and off locally.
- If there is sufficient natural light, the lights on the window side of the room are automatically switched off by means of a brightness–sensitive switch.
- The lights are switched off automatically at 20.00.
- It must be possible at all times to switch the lights on and off locally.

8.5.2 Previous Solution



The lights are operated by means of a current impulse relay controlled by switches at the door. Independently of this, they are reset by the time switch or by the brightness–sensitive switch via the *central off* input. The switching–off commands must be cut by interval time–delay relays so that it is still possible to switch the lights on and off locally after they have been switched off centrally.

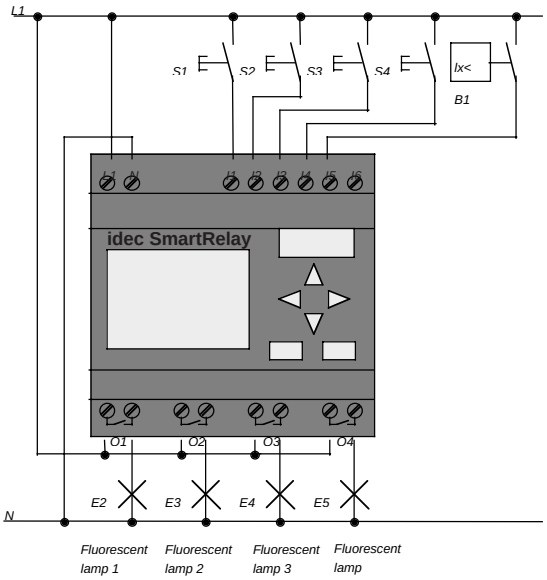
Components required:

- Switches S1 to S4
- Daylight control switch B1
- Time switch E1
- Interval time–delay relays K1 and K2
- Remote–control switches with central off K3 to K6

Disadvantages of the previous solution

- To implement the required functions, a large amount of circuitry is necessary.
- The large number of mechanical components means considerable wear and high maintenance costs can be expected.
- Functional changes are costly to implement.

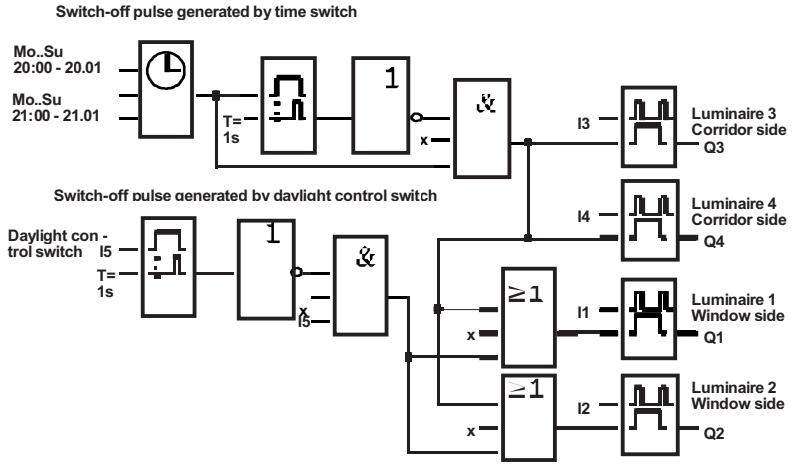
8.5.3 Fluorescent Light Control with FL1A-H10RCB



Components used

- S1 to S4 *(NO contact)* Switches
- B1 *(NO contact)* Daylight control switch

Functional diagram of the IDEC SmartRelay solution



Advantages of the IDEC SmartRelay solution

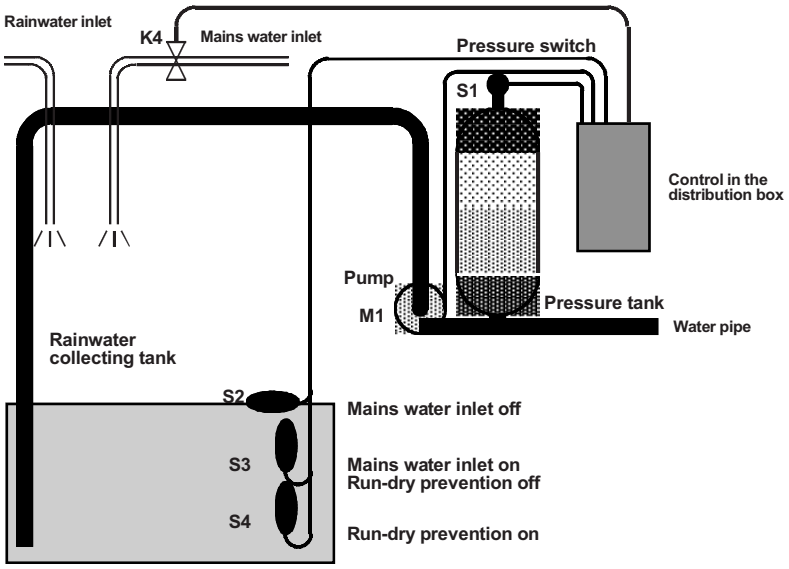
- You can connect the lamps directly to IDEC SmartRelay provided the switching capacity of the individual outputs is not exceeded. In the case of greater capacities, you should use a power contactor.
- Connect the brightness–sensitive switch directly to one of IDEC SmartRelay inputs.
- You don’t need a time switch since this function is integrated in IDEC SmartRelay.
- Fewer switching devices are required so you can install a smaller sub–distribution unit and save space.
- Fewer devices are required
- The lighting system can be easily modified.
- Additional switching times can be set as required (staggered switch–off pulses at the end of the day).
- The brightness–sensitive switch function can easily be applied to all lamps or an altered group of lamps.

8.6 Water Pump

Nowadays, private households are increasingly making use of rainwater alongside the mains domestic water supply. This saves money and helps protect the environment. Rainwater can be used for the following, for example:

- Washing clothes
- Watering the garden
- Watering indoor plants
- Washing the car
- Flushing the toilet

The sketch below illustrates how such a rainwater supply system works:

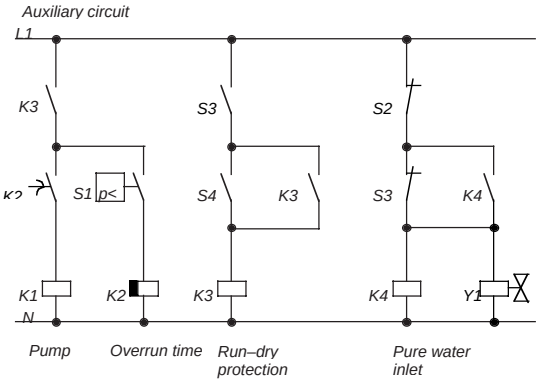


The rainwater is collected in a large water butt. From the water butt it is pumped by a pumping station into a piping system provided for it. From there it can be drawn off in the same way as the normal household water supply. If the water butt should run dry, it can be topped up with mains water.

8.6.1 Demands on the Control System of a Rainwater Pump

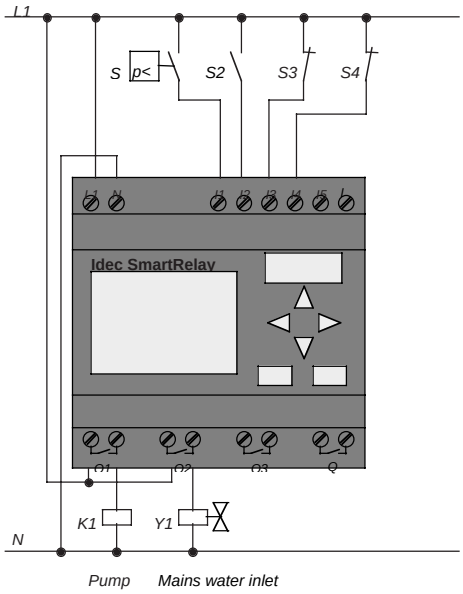
- The system must be capable of supplying water at all times. If necessary, the control system must switch over to mains water if the rainwater runs out.
- The system must not allow rainwater to enter the mains supply when switching over to mains water.
- The pump cannot be switched on if there is not enough water in the rainwater butt (run–dry prevention system).

8.6.2 Previous Solution



The pump and a solenoid valve are controlled by means of a pressure switch and 3 float switches that are fitted in the rainwater butt. The pump must be switched on when the pressure in the cylinder falls below the minimum level. Once the operating pressure has been reached, the pump is switched off again following a short overrun period of a few seconds. The overrun time prevents the water pump continuously cutting in and out if water is drawn off for any length of time.

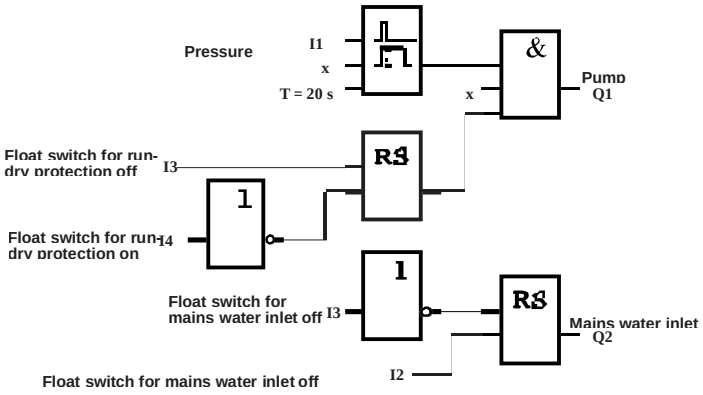
8.6.3 Rainwater Pump with FL1A-H10RCB



Apart from IDEC SmartRelay, you only need the pressure switch and the float switches to control the pump. If you are using a 3–phase AC motor, you must use a master contactor for switching the pump. On systems using single–phase AC pumps, you must fit a contactor if the AC pump requires a higher current than can be switched by the output relay Q1. The power of a solenoid valve is so low that it can normally be controlled directly.

- K1 Master contactor
- Y1 Solenoid valve
- S1 *(NO contact)* Pressure switch
- S2 *(NO contact)* Float switch
- S3 *(NC contact)* Float switch
- S4 *(NC contact)* Float switch

Block diagram of the IDEC SmartRelay solution



8.6.4 Special Features and Enhancement Options

The function diagram shows how you can connect up the control system for the pump and the solenoid valve. Its layout corresponds to that of the current flow diagram. You also have the possibility of incorporating additional functions for specific applications that would only be possible with the inclusion of extra equipment if you were using conventional technology, e.g.:

- Enabling the pump at specific times
- Indication of imminent or existing shortage of water
- Reporting of system faults

8.7 Further Potential Applications

The following are some of the IDEC SmartRelay applications:

- Watering greenhouse plants
- Control of conveyor systems
- Control of a bending machine
- Shop window lighting
- Bell system (e.g. in a school)
- Parking lot surveillance
- Exterior lighting
- Control system for shutters
- Interior and exterior lighting for an apartment block
- Control system for a cream stirrer
- Sports hall lighting
- Equal distribution of 3 loads
- Sequence control system for cable–welding machines with large cross–sections
- Step switch (e.g. for fans)
- Boiler sequence control
- Control system for several pump sets with centralized operation
- Cutting device (e.g. for detonating fuses)
- Monitoring length of use (e.g. in solar energy system)
- Intelligent foot buttons (e.g. to select speeds)
- Control of an elevating platform
- Impregnation of textiles - heating and conveyor control system
- Silo–filling system

And many more.

You can also find descriptions and the relevant circuit diagrams of the applications on the Internet. You can read these *.pdf files with Adobe Acrobat Reader. If you have installed the WindLGC programming software on your PC, you can download the relevant circuit diagrams, adapt them to your requirements, transfer them into IDEC SmartRelay via the PC cable and implement them.

Advantages of using IDEC SmartRelay

- Replace a number of auxiliary switching devices with the integrated functions of IDEC SmartRelay.
- Save yourself wiring and installation work (because the wiring is done in IDEC SmartRelay).
- Reduce the space required for components in the control cabinet/distribution box. You may be able to use a smaller control cabinet/distribution box.
- Add or change functions subsequently without having to install an additional switching device or change the wiring.
- Provide your customers with additional functions for their domestic or building installation. Here are some examples:
  - Home security: You can program IDEC SmartRelay to switch a lamp on regularly or open and close your shutters while you are on holiday.
  - Heating system: You can program IDEC SmartRelay to run the circulation pump only when water or heat is really required.
  - Cooling systems: You can program IDEC SmartRelay to thaw your cooling systems automatically on a regular basis to save energy costs.
  - You can illuminate aquaria and terraria automatically on a time–dependent basis.

You can also:

- Use commercially available switches and buttons, which makes it easy to integrate in the installation.
- Connect IDEC SmartRelay directly to your domestic installation due to its integrated power supply.

A Technical Specifications

A.1 General Technical Specifications

Criterion	Complies with	Values
Dimensions (WxHxD) Weight Installation		72 x 90 x 55 mm Approx. 190 g On 35 mm DIN rail width of 4 modules
Climatic environmental conditions		
Ambient temperature Horizontal installation	Cold: IEC 68–2–1	0 ... 55 °C
Vertical installation	Heat: IEC 68–2–2*	0 ... 55 °C
Storage/transport		*40 °C ... +70 °C
Relative humidity	IEC 68–2–30	From 5 to 95 % no condensation
Air pressure		795 ... 1080 hPa
Pollutants		Free from corrosive gases
Mechanical environmental conditions		
Type of protection		IP20
Vibrations:	IEC 68–2–6	10 ... 57 Hz (constant amplitude 0.15 mm) 57 ... 150 Hz (constant acceleration 2 g)
Shock	IEC 68–2–27	18 shocks (Half-sine 15g/11ms)
***IEC 68 includes VDE 0631**		
Drop	IEC 68–2–31	Drop height 50 mm
Free fall (packaged)	IEC 68–2–32	1 m
Electromagnetic compatibility (EMC)		
Electrostatic discharge	IEC 801–2 Severity 3	8 kV air discharge 6 kV contact discharge

Criterion	Complies with	Values
Electromagnetic fields	IEC 801–3	Field strength 10 V/m
Interference suppression	EN 55011	Limit class B group 1
EMC emitted interference	EN 50081–2	
Interference immunity	EN 50082–2	
Burst pulses	IEC 801–4 Severity 3	2 kV (supply and signal lines)
Energy carriers Single pulse (surge) (applies only to FL1A-H10RCB, FL1A-B10RCB)	IEC 801–5 Severity 2	0.5 kV (power lines) symmetrical 1 kV (power lines) asymmetrical
Information on IEC* / VDE * safety		
Measurement of clearance and creepage distance	IEC 664, IEC 1131, EN 50178 draft 11/94 UL 508, CSA C22.2 No 142 Also VDE 0631 for FL1A-H10RCB, FL1A-B10RCB	Fulfilled
Insulation strength	IEC 1131	Fulfilled

A.2 Technical Specifications: FL1A-H10RCB, FL1A-B10RCB

	FL1A-H10RCB **FL1A-B10RCB**
Power supply	
Input voltage	100/240 V AC
Permissible range	85 ... 264 V AC
Permissible mains frequency	47 ... 63 Hz
Power consumption • 100 V AC • 240 V AC	 10 ... 30 mA 10 ... 20 mA
Voltage failure bridging • 100 V AC • 240 V AC	 Typically 10 ms Typically 20 ms
Power loss at • 100 V AC • 240 V AC	 1.1 ... 3.5 W 2.3 ... 4.6 W
Clock buffering at 25 _C	Typically 80 h
Accuracy of the real-time clock	Max. ”5 s a day
Digital inputs	
Number	6
Electrical isolation	No
Input voltage L1 • Signal 0 • Signal 1	 < 40 V AC > 79 V AC
Input current at • Signal 0 • Signal 1	 < 0.03 mA > 0.08 mA
Delay time at • 0 after 1 • 1 after 0	 Typically 50 ms Typically 50 ms
Line length (unshielded)	100 m

	FL1A-H10RCB **FL1A-B10RCB**
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
In groups of	1
Activation of digital input	Yes
Continuous current I_{th} (per connector)	Max. 10 A
Incandescent lamp load (25,000 switching cycles) at 230/240 V AC 115/120 V AC	 1000 W 500 W
Fluorescent tubes with electr. control gear (25,000 switching cycles)	10 x 58 W (at 230/240 V AC)
Fluorescent tubes, conventionally compensated (25,000 switching cycles)	1 x 58 W (at 230/240 V AC)
Fluorescent tubes, uncompensated (25,000 switching cycles)	10 x 58 W (at 230/240 V AC)
Short circuit-proof cos 1	Power protection B16 600A
Short-circuit proof cos 0.5 to 0.7	Power protection B16 900A
Parallel switching of outputs to increase power	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz
Minimum Switching Load	500mA, 12V

	FL1A-H10RCB **FL1A-B10RCB**
Initial Contact Resistance	100mOhm at 1A at 24V
Mechanical Life	10Million (No Load: 10Hz)

A.3 Technical Specifications: FL1A-H12SND, FL1A-H10RCA, FL1A-B10RCA

	FL1A-H12SND	FL1A-H10RCA FL1A-B10RCA
Power supply		
Input voltage	24 V DC	24 V AC
Permissible Range	20.4 to 28.8 V DC	20.4 ... 26.4 V AC
Power consumption from 24 V DC	10 ... 20 mA	15 ... 120 mA
Voltage failure bridging		Typically 5 ms
Power loss at 24 V	0.2 ... 0.5 W	0.3 ... 1.8 W (AC)
Clock buffering at 25 _C		Typically 80 h
Accuracy of the real-time clock		Max. ”5 s a day
Digital inputs		
Number	8	6
Electrical isolation	No	No
Input voltage L+ • Signal 0 • Signal 1	 < 5 V DC > 8 V DC	 < 5 V AC > 12 V AC
Input current at • Signal 0 • Signal 1	 < 0.3 mA (I1...I6) < 0.05 mA (I7, I8) > 1.0 mA (I1...I6) > 0.1 mA (I7, I8)	 < 1.0 mA > 2.5 mA
Delay time at • 0 after 1 • 1 after 0	 Typically 1.5 ms Typically 1.5 ms	 Typically 1.5 ms Typically 15 ms
Line length (unshielded)	100 m	100 m
Analog inputs		
Number	2 (I7, I8)	
Range	0 ... 10 V DC	
Digital outputs		
Number	4	4

	FL1A-H12SND	**FL1A-H10RCA** **FL1A-B10RCA**
Output type	Transistor, current-sourcing	Relay outputs
Electrical isolation	No	Yes
In groups of		1
Activation of digital input	Yes	
Output voltage	¢ Supply voltage	
Output current	Max. 0.3 A	
Continuous current I_{th}		Max. 10 A
Incandescent lamp load (25,000 switching cycles) at		1000 W
Fluorescent tubes with electr. control gear (25,000 switching cycles)		10 x 58 W
Fluorescent tubes, conventionally compensated (25,000 switching cycles)		1 x 58 W
Fluorescent tubes, uncompensated (25,000 switching cycles)		10 x 58 W
Short circuit-proof and overload-proof	Yes	
Short-circuit current limitation	Approx. 1 A	
Derating	None throughout the entire temperature range	
Short circuit-proof cos 1		Power protection B16 600A
Short-circuit proof cos 0.5 to 0.7		Power protection B16 900A
Parallel switching of outputs to increase power	Not permitted	Not permitted

	FL1A-H12SND	**FL1A-H10RCA** **FL1A-B10RCA**
Protection of output relay (if desired)		Max. 16 A, characteristic B16
Switching rate		
Mechanical		10 Hz
Electrical	10 Hz	
Ohmic load/lamp load	10 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz
Minimum Switching Load		500mA, 12V
Initial Contact Resistance		100mOhm at 1A at 24V
Mechanical Life		10Million (No Load: 10Hz)

A.4 Technical Specifications: FL1A-H12RCE, FL1A-B12RCE

	FL1A-H12RCE FL1A-B12RCE
Power supply	
Input voltage	12/24 V DC
Permissible range	10.8 ... 15.6 V DC 20.4 ... 28.8 V DC
Power consumption	10 ... 120 mA (from 12/24 V DC)
Voltage failure bridging	Typically 5 ms
Power loss	0.1 ... 1.2 W (at 12/24 V DC)
Clock buffering at 25 _C	Typically 80 h
Accuracy of the real-time clock	Max. ”5 s a day
Electrical isolation	No
Reverse polarity protection	Yes
Digital inputs	
Number	8
Electrical isolation	No
Input voltage L+ • Signal 0 • Signal 1	 < 5 V DC > 8 V DC
Input current at • Signal 0 • Signal 1	 < 1.0 mA > 1.5 mA
Delay time at • 0 after 1 • 1 after 0	 Typically 1.5 ms Typically 1.5 ms
Line length (unshielded)	100 m
Analog inputs	
Number	2 (I7, I8)
Range	0 ... 10 V DC

	FL1A-H12RCE FL1A-B12RCE
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
In groups of	1
Activation of digital input	Yes
Output voltage	
Output current	
Continuous current I_{th} (per connector)	Max. 10 A
Incandescent lamp load (25,000 switching cycles) at	1000 W
Fluorescent tubes with electr. control gear (25,000 switching cycles)	10 x 58 W
Fluorescent tubes, conventionally compensated (25,000 switching cycles)	1 x 58 W
Fluorescent tubes, uncompensated (25,000 switching cycles)	10 x 58 W
Short circuit-proof and overload-proof	
Short-circuit current limitation	
Derating	None throughout the entire temperature range
Short circuit-proof cos 1	Power protection B16 600A
Short-circuit proof cos 0.5 to 0.7	Power protection B16 900A
Parallel switching of outputs to increase power	Not permitted

	FL1A-H12RCE **FL1A-B12RCE**
Protection of output relay (if desired)	Max. 16 A, characteristic B16
Switching rate	
Mechanical	10 Hz
Electrical	
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz
Minimum Switching Load	500mA, 12V
Initial Contact Resistance	100mOhm at 1A at 24V
Mechanical Life	10Million (No Load: 10Hz)

Switching capacity and service life of the relay outputs

Ohmic load

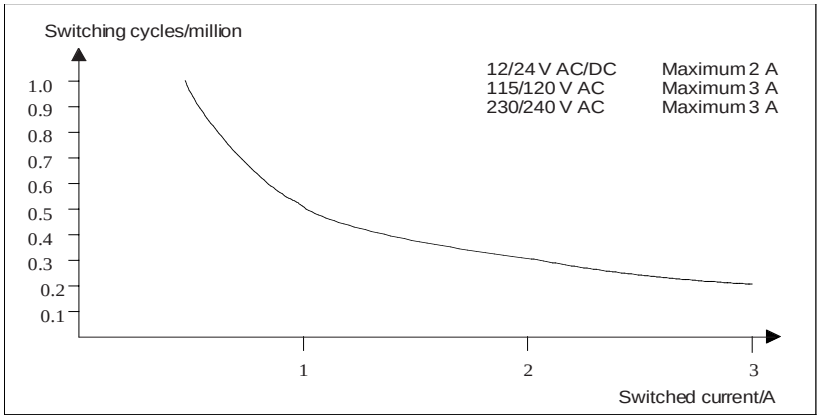


Figure A Switching capacity and service life of the contacts at ohmic load (heating)

Inductive load

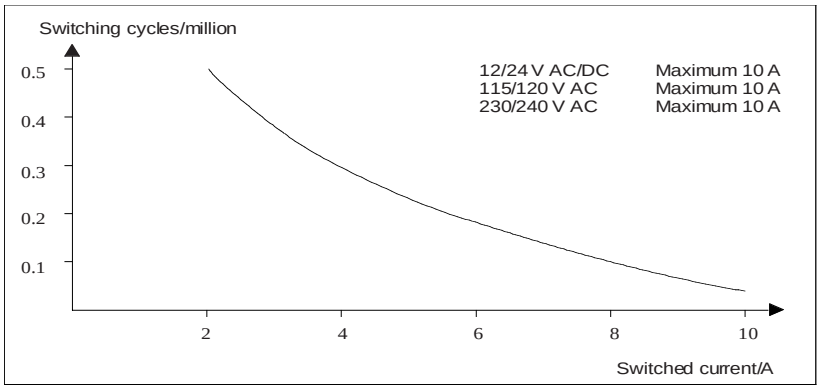


Figure B Switching capacity and service life of the contacts at highly inductive load to IEC 947–5–1 DC13/AC15 (contactors, solenoid coils, motors)

B Determining Memory Requirements

Use of memory areas

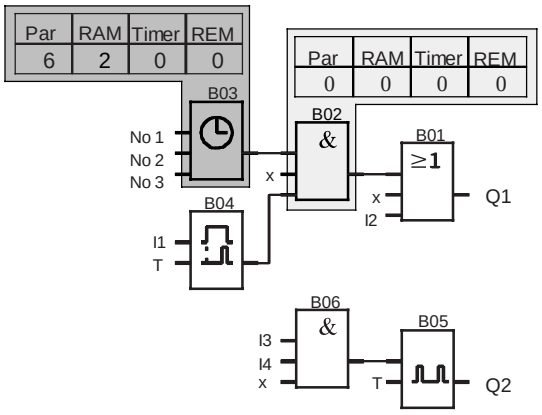
If you are unable to enter another block when you are entering a program, this means a memory area is completely occupied. IDEC SmartRelay only offers you the blocks that will still fit into IDEC SmartRelay. If no more blocks from a list fit into IDEC SmartRelay, you will not be able to select the list again.

If a memory area is occupied, you have to optimize your circuit or use a second IDEC SmartRelay.

Determining the amount of memory required

When you calculate the memory requirements of a circuit, you must always include all the individual areas of the memory.

Example:



The example program consists of the following:

Block no.	Function	Memory area				
		Par	RAM	Timer	REM	Blocks
B01	OR	0	0	0	0	1
B02	AND	0	0	0	0	1
B03	Time switch	6	2	0	0	1
B04	On delay	1	1	1	0	1
B05	Clock pulse generator	1	1	1	0	1
B06	AND	0	0	0	0	1
	Resources occupied by the program	8	4	2	0	6
	Memory limitations in IDEC SmartRelay	48	27	16	15	56
	Still available in IDEC SmartRelay	40	23	14	15	50

The program therefore fits into IDEC SmartRelay.

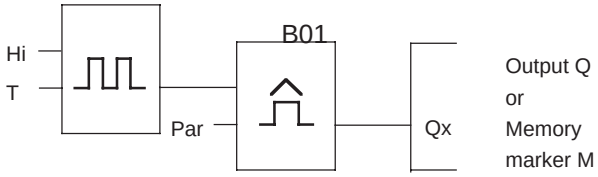
C Determining the Cycle Time

The program cycle is the complete execution of the program, primarily the reading in of the inputs, the processing of the program and the subsequent reading out of the outputs. The cycle time is the time required to execute a program once in full.

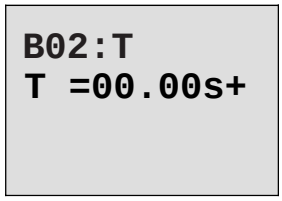
The time required for a program cycle can be determined using a short test program. The test program is created in IDEC SmartRelay and produces a value during processing in parameterization mode from which the current cycle time can be calculated.

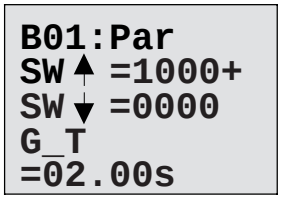
Test program

1. Create the test program by linking an output or marker to a threshold switch and by switching a clock pulse generator at its input, which is switched on by a hi signal.

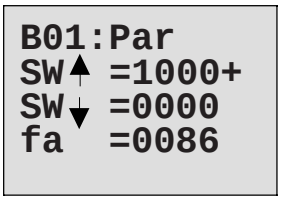


2. Parameterize the two blocks as shown below. A clock pulse is generated in each program cycle based on the cycle time of 0 seconds. The time interval of the threshold switch is set to 2 seconds.





3. *Then start the program and switch IDEC SmartRelay to parameterization mode. You can look at the parameters for the threshold switch in parameterization mode.*



fa= is the sum of the pulses measured per time unit G_T

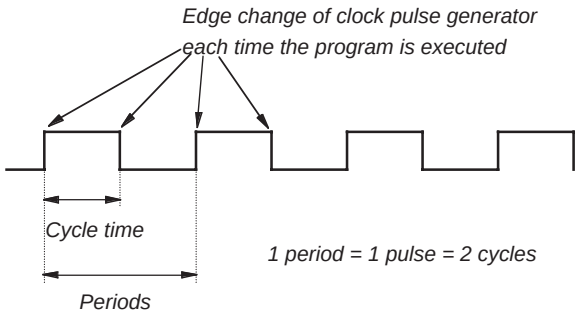
4. *The inverse value of fa is equal to the cycle time of IDEC SmartRelay with the current program stored in the memory.*

   1/fa = cycle time in seconds

Explanation

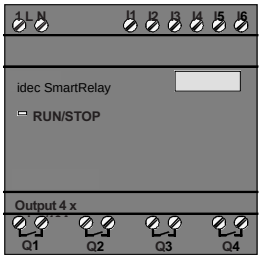
The clock pulse generator (T=0) changes its output signal every time the program is executed. A level (high or low) thus lasts exactly one cycle. A period therefore lasts 2 cycles.

The threshold switch indicates the ratio of periods per 2 seconds which results in the ratio of cycles per second.



D IDEC SmartRelay Without a Display

The FL1A-B12RCE, FL1A-B10RCA and FL1A-B10RCB variants were developed without a display because some special applications don't need operating units such as keypads and a display during operation.



Less is definitely more!

The advantages for you:

- More cost–efficient than models with a display.
- Requires less space in the cabinet than conventional hardware.
- More flexible and less costly than separate hardware units.
- Advantageous for applications in which two or three conventional switching devices can be replaced.
- Very easy to use.
- Cannot be used by unauthorized persons.
- Compatible with FL1A-H12SND, FL1A-H12RCE, FL1A-H10RCA and FL1A-H10RCB.

Programming without an operating unit

There are two ways to program IDEC SmartRelay without a display:

- Create a program with WindLGC on the PC and transfer the program to IDEC SmartRelay
- Transfer the program from a IDEC SmartRelay memory cartridge to your IDEC SmartRelay without a display.

Operating characteristics

Once the power supply has been connected, IDEC SmartRelay is ready for operation. You can switch off IDEC SmartRelay without a display by disconnecting the power supply, for example by removing the plug.

You can’t use a key combination to set up FL1A-B12RCE, FL1A-B10RCA and FL1A-B10RCB for data transfer, and programs cannot be stopped or started using keys. FL1A-B12RCE, FL1A-B10RCA and FL1A-B10RCB therefore have modified startup characteristics.

Startup characteristics

If a IDEC SmartRelay memory cartridge is inserted, a program stored there will be copied to the device immediately after IDEC SmartRelay has been switched on, thus overwriting an existing program.

If a PC-CABLE is inserted, IDEC SmartRelay automatically goes into PC ´ IDEC SmartRelay mode when it is switched on. Using the PC software WindLGC you can read the programs from IDEC SmartRelay or store them on IDEC SmartRelay.

If there is already a valid program in the memory cartridge, IDEC SmartRelay will automatically transfer from STOP to RUN after power has been switched on.

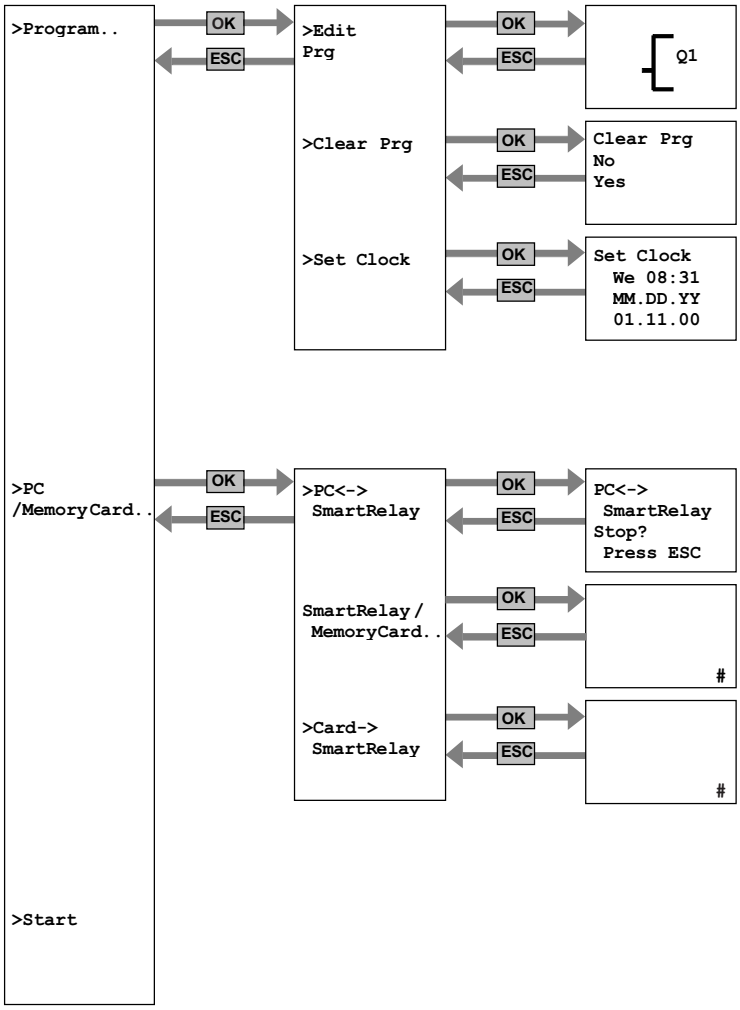
Operating status indicator

Operating statuses, such as Power On, RUN and STOP are indicated by an LED on the front hood.

- Red LED: PowerOn/STOP
- Green LED: PowerOn/RUN

After the power supply has been switched on and whenever IDEC SmartRelay is not in RUN mode, the red LED comes on. When IDEC SmartRelay is in RUN mode, the green LED comes on.

E IDEC SmartRelay Menu Structure



F Type Numbers

Table. A Type List

Rated Power Voltage	Input Type (Digital)	Input Type (Analog)	Output Type (Relay)	Display and Keypad	Real time Clock	Type No.
12/24V DC	6	2	4	Yes	Yes	FL1A-H12RCE
12/24V DC	6	2	4	-	-	FL1A-B12RCE
24V DC	6	2	(4)Tr	Yes	-	FL1A-H12SND
24V AC	6	-	4	Yes	Yes	FL1A-H10RCA
24V AC	6	-	4	-	Yes	FL1A-B10RCA
100-240V AC	6	-	4	Yes	Yes	FL1A-H10RCB
100-240V AC	6	-	4	-	Yes	FL1A-B10RCB

Table. B Cable and Accessories

Name	Function	Type No.
Memory Cartridge (Yellow)		FL1A-PM1
Memory Cartridge (Red)		FL1A-PM2
PC Cable		FL1A-PC1
WindLGC		FL9Y-LP1CDW

G Abbreviations

B01	Block number B01
BF	Basic functions
C	SmartRery device designation: integrated clock
Cnt	Count = input for counter
Co	Connector
Dir	Direction (e.g. for counter)
En	Enable (e.g. for switching on the clock pulse generator)
No	Cams (time switch parameters)
o	SmartRery device designation: without display
Par	Parameter
R	Reset
R	SmartRery device designation: relay outputs
S	Set (e.g. setting the latching relay)
SF	Special functions
T	Time (parameter)
Trg	Trigger (parameter)